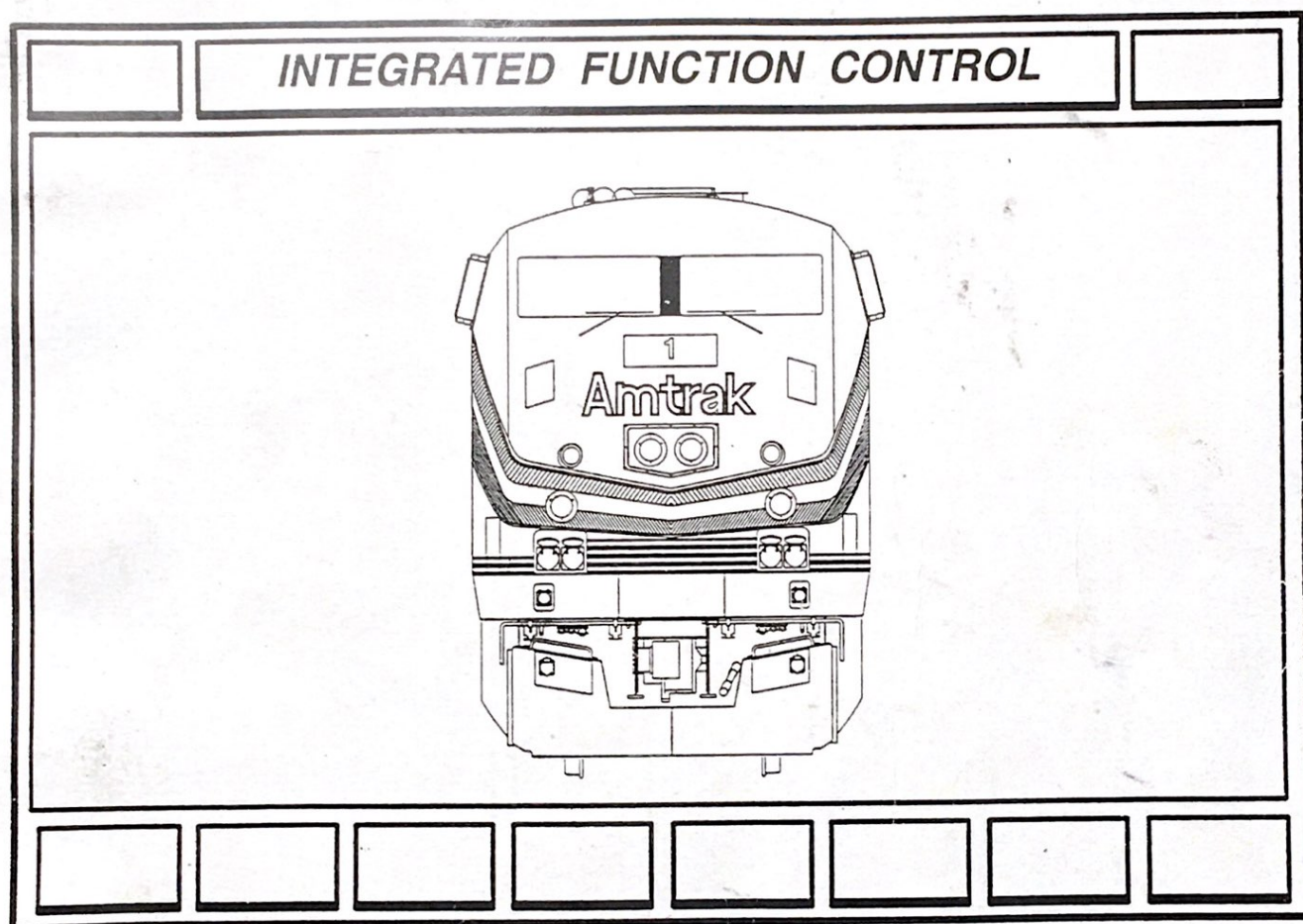




GEJ-6784

# *P42-DC Operating Manual*



LASER RED  
RED 032 C  
PLATE

**GENESIS<sup>TM</sup>**  
**SERIES 1**

*Passenger Locomotives*

PRINT BLACK PLATE EXCEPT FOR LASER RED AND PROCESS BLUE PLATES IDENTIFIED WITH CALLOUTS



## SETTING UNIT AS A LEADING UNIT

To set-up the locomotive as a Lead unit of a consist, first make the necessary preliminary preparations for operation then proceed as follows:

### Air Equipment Set-Up

1. Apply parking brake.
2. Move the Independent Brake handle to the FULL APPLICATION position.
3. Move the brake pipe cut-off pilot switch to the TEST position on Brake Controller.
4. Move Automatic Brake handle to RELEASE position.
5. Wait for equalizing reservoir pressure to increase above current brake pipe pressure.
6. Move the brake pipe cut-off pilot switch to FREIGHT or PASSENGER position.
7. Adjust regulating valve setting according to Railroad Rules and Regulations.
8. Test the air brake in accordance with Railroad Rules and Regulations.
9. Release parking brake before moving locomotive.

### Electrical Set-Up

1. Close the Control circuit breaker on the control console right. (The Control circuit breaker must be closed on the Lead unit only.)
2. Close the Engine Run circuit breaker. (This circuit breaker must be closed on the Lead unit only.)
3. Close the Dynamic Brake circuit breaker.
4. Close the required circuit breakers on the Engine Control (EC) panel.
5. Move the MU Headlight Set-Up switch to the required position.
7. Insert the **Reverser** Handle into the Controller.
8. When ready to move locomotive, move EC switch to RUN position, close Generator Field circuit breaker, and move Reverser handle to desired direction.
9. Verify that the HEP Control Panel is set as required.
10. Operate the locomotive in accordance with operating procedure.

## SETTING UNIT AS A TRAILING UNIT OR PUSH

To set-up the locomotive as a Trail unit of a consist, or Push, proceed as follows:

**NOTE: Refer to ELECTRONIC AIR BRAKE section of this manual for Air Brake Setup if more information is needed.**

### Air Equipment Set-up

1. Make a Full Service application with the Automatic Brake handle.
2. Wait for air exhaust to stop.
3. Move the brake pipe cut-off pilot switch to TRL position.
4. Move the Automatic Brake handle to the HANDLE OFF position.
5. Place the Independent Brake handle in the RELEASE position.

### Electrical Set-Up

1. Move the **Reverser** Handle to OFF and remove the handle.
2. Open the Generator Field, Control, Engine Run and Dynamic Brake circuit breakers on control console right.

**NOTE: Control circuit breaker must be closed (ON) in Push Mode.**

3. Turn off desired circuit breakers on top row for Trail/Push depending on territory to be operated in. The second row of breakers MUST BE ON for Trail/Push operation. The Running Lights circuit breaker may be positioned as desired.
4. Place the MU Headlight Set-Up switch in the proper position.
5. Verify that the HEP Control Panel is set as required.



## **PENALTY BRAKE RECOVERY**

There are three ways a Penalty Brake application may be initiated: From the Alerter; Because of Overspeed; From the Cab Signal/Inductive Train Stop System. A Penalty Brake is annunciated on the IFD screens. An IITS is indicated on the Engineer's display panel as a red light. Reset these conditions as follows:

### **Alerter Penalty**

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Reset Alerter.
4. Allow time-out per operator message on the IFD Display.
5. Move the Automatic Brake handle to RELEASE and charge the brake system. Alerter must have been reset or the brake pipe (BP) will only charge to 50 psi and then reduce.

### **Locomotive Overspeed Penalty**

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Reduce locomotive speed to below limit.
4. Allow time-out per operator message on the IFD Display.
5. Move the Automatic Brake handle to RELEASE and charge the brake system.

### **Cab Signal Penalty**

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Acknowledge Cab Signal.
4. Reduce locomotive speed to limit imposed by Cab Signal.
5. When Cab Signal system resets, the red overspeed light on the cab signal display panel will turn off.
6. Allow time-out per operator message on the IFD Display.
7. Move the Automatic Brake handle to RELEASE and charge the brake system.

### **IITS Penalty**

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to the SUP (suppression) position.
3. Depress and hold the acknowledgement button (red) on the engineer's control console for approximately two (2) seconds.
4. Depress and hold the ATS reset button (small black button) for at least two seconds.
5. Allow time-out per operator message on the IFD Display.
6. After the red ATS light labeled "overspeed" on the cab signal control panel and the PCS light go out, move the Automatic Brake handle to the RELEASE position.



## **OPERATING MANUAL**

# **GENESIS SERIES 1 P42-DC DIESEL-ELECTRIC LOCOMOTIVES**

## **WITH INTEGRATED FUNCTION CONTROL**

## **FOR AMTRAK ROAD NUMBERS: 1-98**

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## FOREWORD

**NOTE:** *The purpose of this manual (and the data included) is to act as a "guide" in the operation of this locomotive. The presence or absence of coverage for any particular system or component in no way implies that the equipment is or is not part of any specific locomotive. Minor differences encountered in equipment are because of changes made after the manual was released for printing. These changes will be covered in subsequent editions of this manual. For further details, refer to the Training Modules and the Locomotive RUNNING MAINTENANCE and BACKSHOP manuals.*

WELCOME to the GE P42-DC Locomotive. The operating compartment has been developed to provide the operating crew more comfort and to localize most of the control operation in front of the engineer at the control console. This locomotive is equipped with the Integrated Function Control (IFC) —an integrated control system enabling the crew to have the important operating parameters (gauges, annunciator lights, etc.) at their finger tips. This concept will be explained further in the IFC Section of this manual.

In an effort to maintain a consistency of terminology between this unit and the other General Electric units (as well as other manufacturer units) in the fleet, the front of this unit will be called "short hood" (marked with an **F**) and the rear of this unit will be called "long hood."

This Operating Manual is arranged in sections: SUMMARY OF WARNINGS AND CAUTIONS, INTRODUCTION, CAB EQUIPMENT, AIR BRAKE EQUIPMENT, AUX CAB EQUIPMENT, ENGINE/RADIATOR COMPARTMENT EQUIPMENT including a grouping of the various functions available (e.g.: CRUISE CONTROL; SLOW SPEED BACKING) and TROUBLESHOOTING. Locate these needed sections easily by using the following CONTENTS Section.

The SUMMARY OF WARNINGS AND CAUTIONS Section lists (in one place) certain safety-related conditions which require specific action. They are repeated in the text where needed. **Please read this section now, before proceeding to other sections of this Manual.**

The INTRODUCTION Section describes and gives a basic overview of the locomotive. The CAB EQUIPMENT Section continues this overview by identifying the associated hardware located in the operating compartment. A brief description of the equipment is also included.

The AIR BRAKE EQUIPMENT Section lists and explains some of the principal parts of the air brake system while the AUX CAB EQUIPMENT and ENGINE/RADIATOR Sections list and explain control equipment found in Control Areas 2, 3, 4, 5 and 9. Also included in this section are illustrations and text explaining the Engine Start Station, Water System Draining and important Gauges of which the operator should be aware.

The OPERATING PROCEDURES Section gives step-by-step instructions for locomotive operation as well as listing various functions available for use. The sections on Dynamic Braking and use of Blended Braking will be of great interest. These step-by-step instructions along with a grouping of the various control functions included on this locomotive should answer any common operation questions. If a problem arises, proceed to the TROUBLESHOOTING Section.

The TROUBLESHOOTING Section lists, describes and illustrates the various Alarms, Safeguards, Power Derations and Shutdown Situations an operator may encounter. This section is included last in the manual for operator convenience.

The equipment displayed and explained in this manual is the next step in General Electric Transportation Systems program to enable a complete, totally-integrated, computer control of the locomotive. Future enhancements will be developed and added as technology provides. **Comments are appreciated.** Please send any comments to your local GE representative or mail to:

GENERAL ELECTRIC CO.  
2901 East Lake Road  
Erie, PA 16531

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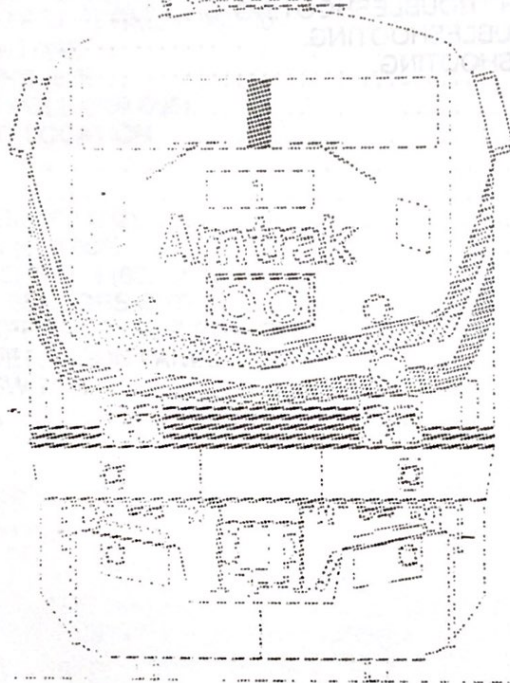
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■ Revisions are indicated by marginal bars.



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| 100  | REVERSE LIGHT INDICATOR      | 100  |



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Revisions are indicated by revision code.



## SUMMARY OF WARNINGS AND CAUTIONS

The following is a summary of safety precautions which must be observed when operating this General Electric Locomotive. WARNINGS indicate the potential for danger to personnel, and CAUTIONS indicate the potential for damage to the equipment. The Manual Section where the precaution is located is listed above the precaution. The precautions are repeated where applicable throughout the manual.

### CALIFORNIA Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

## WARNINGS:

### CAB EQUIPMENT

Finding the Combined Power Handle away from IDLE with the Reverser Handle removed indicates that interlocking between handles requires repair or adjustment. Do not attempt to operate unit until condition has been repaired.

### CAB EQUIPMENT, AIR BRAKE EQUIPMENT

To ensure safe consist operation, follow specific Railroad Rules for setting-up units for "Trail," "Dead," or "Push."

### AIR BRAKE EQUIPMENT, OPERATING RESTRICTIONS, AIR BRAKE TROUBLESHOOTING

**STOPPING HAZARD.** Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 50 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

### AIR BRAKE EQUIPMENT, OPERATING PROCEDURES, AIR BRAKE TROUBLESHOOTING

**WARNING: STOPPING HAZARD.** If 24 Volt power loss and Locomotive battery power loss to the NYAB/KNORR System occurs or system experiences an internal fatal failure, on LEAD UNIT, while train is in motion, a SERVICE Brake application is made (BP goes to zero and BC goes to 90 psig). Operator may NOT bail off BC pressure. Operator may still initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Control Console Left or moving the Automatic Brake Handle to EMERGENCY position.

### AIR BRAKE EQUIPMENT

Rotating Equipment the air compressor motor could start at any time. Disable the compressor drive contactors by opening the Local Control Circuit Breaker (LCCB) before checking or change the air compressor oil.

### AIR BRAKE EQUIPMENT

Do not allow the locomotive to operate in this mode unattended. The compressor governor switch is "locked out of the compressor control circuit at this time. The safety valve will open when the pressure reaches its operating pressure, but not other device will keep main reservoir pressure within safe limits.

### AIR BRAKE EQUIPMENT

Compressed air is extremely dangerous if not handled carefully. When working with compressed air equipment, DO NOT attempt to service, repair or break any connections without bleeding ALL air pressure from the device and ALL piping leading to it.

### AIR BRAKE EQUIPMENT

Chock wheels. Once parking brake is manually released, it can only be applied again if main reservoir air is supplied to the locomotive or dead engine feature is cut-in with brake pipe pressure set at or above 90 psig on locomotive.

### AUXILIARY COMPARTMENT EQUIPMENT, TROUBLESHOOTING

High voltage is present in this compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and shutdown HEP.

### ENGINE/RADIATOR COMPARTMENT EQUIPMENT

Falls while moving between equipment can cause severe injury or death. This locomotive has no rear platform due to limited clearances. Use extreme caution when passing between locomotive and adjacent equipment. Pass only in accordance with railroad procedures.

### ENGINE/RADIATOR COMPARTMENT EQUIPMENT

High voltage is present in Control Area 9. When the door to Control Area 9 is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before opening the door to this area, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and shut down HEP.



**ENGINE/RADIATOR COMPARTMENT EQUIPMENT**

To avoid personal harm from engine cooling water burns, when the water level is above FULL AT IDLE mark, NEVER remove the water fill cap. If over-full, open manual drain valve (near water pump) to reduce the water to a safe level.

**TROUBLESHOOTING**

Electrical Hazard. Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

**CAUTIONS:****CAB EQUIPMENT**

It is recommended that the traction motor cut-out switches be operated only with the Engine Control switch in START or ISOLATE position so the unit is isolated and the Combined Power Handle in IDLE. Dynamic Brake operation will be affected.

**CAB EQUIPMENT**

To avoid equipment damage, properly set-up this locomotive when hauling dead-in-train. Brake Pipe pressure on Controlling Unit must be set to 90 psig or greater. If brake pipe cannot be set to 90 psig or higher on controlling locomotive, the Parking Brake must be manually released. (See page 45.)

**ENGINE/RADIATOR COMPARTMENT EQUIPMENT**

Summer/Winter doors must remain closed when ambient temperature is above freezing 32° F (0° C). Failure to do so can derate equipment or cause equipment failure.

**ENGINE/RADIATOR COMPARTMENT EQUIPMENT**

Prior to adding water, ALWAYS relieve any system pressure by opening the vent valve (red handle) for 60 seconds. Close the vent valve by releasing handle.

**ENGINE/RADIATOR COMPARTMENT EQUIPMENT, TROUBLESHOOTING**

During freezing weather, protect the engine cooling system according to railroad instructions.

**SAFETY DEVICES**

Starting the Alerter Magnet Valve Test will apply a Full Service Brake application on the locomotive.

**HEP**

The 480V jumper cables must always be installed in proper receptacles to prevent cable damage.

**ENGINE STARTING/SHUTDOWN**

Do not discharge the battery excessively by repeated attempts to start. If the first two or three tries are unsuccessful, recheck the starting procedure.

**OPERATING PROCEDURES**

The control system of this locomotive will slightly delay movement from power to dynamic braking. If however, other locomotives in the consist do not have this feature, to prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with the Combined Power Handle at IDLE.

**OPERATING PROCEDURES**

After a locomotive has operated at full load, allow the engine to run at IDLE for at least five minutes before shutting down. Otherwise, immediate shutdown after such operation could be harmful to some engine components.

**TROUBLESHOOTING**

If the Battery Charge and Computer circuit breaker is turned off (OPENED) on the LEAD unit while the train is in motion, a FULL SERVICE Brake application is made at a SERVICE rate (BP goes to zero) with PCS. In addition, if unit is LEAD or TRAIL, power (load) is dropped.

**TROUBLESHOOTING**

It is recommended that motors only be manually cut out when the Engine Control switch is in START or ISOLATE position (unit isolated) and the Combined Power Handle is in IDLE.

**TROUBLESHOOTING**

If the slip/axle warn light is lit continuously, STOP locomotive and inspect ALL wheels in the locomotive consist to ensure they are rotating freely.

**TROUBLESHOOTING**

Keep Clear of Moving Parts.

**TROUBLESHOOTING**

Always follow Railroad Rules and Instructions for hot axle or support bearing.

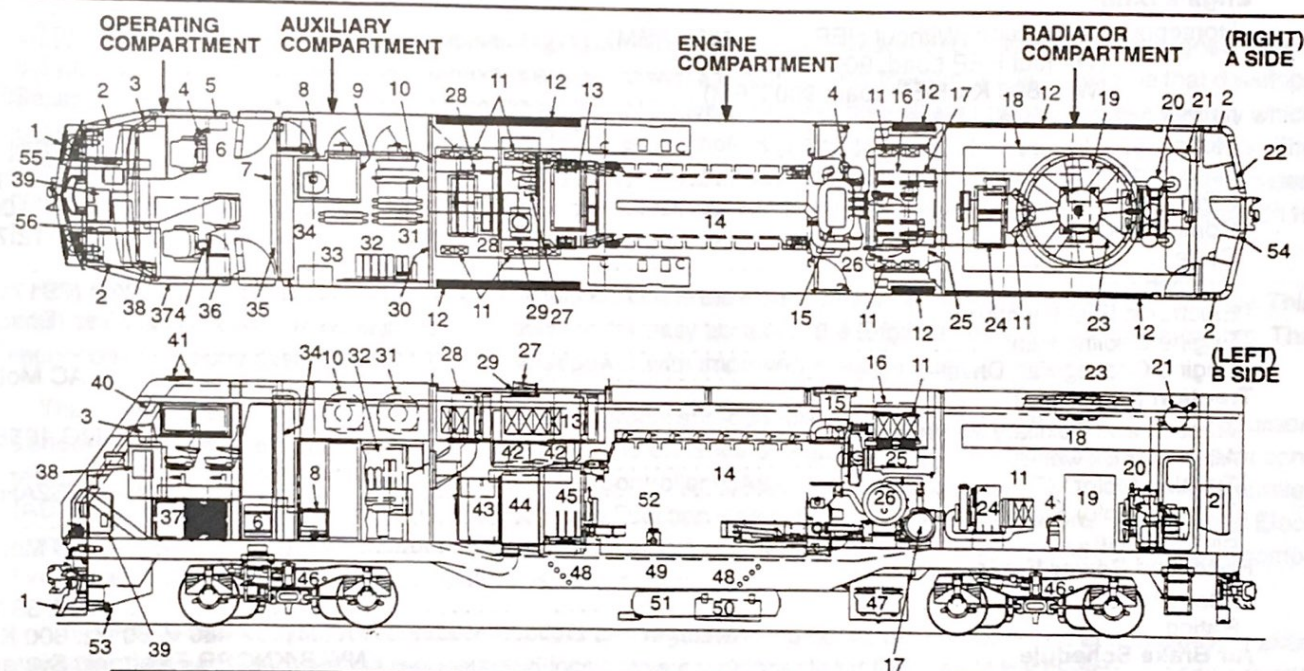
**TROUBLESHOOTING**

If the slip/axle warn light is lit continuously, STOP locomotive and inspect ALL wheels in the locomotive consist to ensure they are rotating freely.



## INTRODUCTION

## LOCATION OF APPARATUS



| REF. | DESCRIPTION                         | REF. | DESCRIPTION                  |
|------|-------------------------------------|------|------------------------------|
| 1    | SNOW PLOW                           | 29   | QUALCOM ANTENNA              |
| 2    | SAND BOX                            | 30   | CONTROL AREA 4 (CA4)         |
| 3    | CONTROL CONSOLE RIGHT               | 31   | DYNAMIC BRAKING GRIDS        |
| 4    | FIRE EXTINGUISHER                   | 32   | CONTROL AREA 3 (CA3)         |
| 5    | AUXILIARY CAB HEATER                | 33   | HEAD END POWER EQUIPMENT     |
| 6    | AIR BRAKE RACK (RIGHT SIDE)         | 34   | CONTROL AREA 2 (CA2)         |
| 7    | ENGINE CONTROL (EC) PANEL           | 35   | CONTROL AREA 1 (CA1)         |
| 8    | TOILET                              | 36   | REFRIGERATOR                 |
| 9    | CONTROL AREA 5 (CA5)                | 37   | HEATER/AC UNIT (LEFT SIDE)   |
| 10   | DYNAMIC BRAKE BLOWER                | 38   | CONTROL CONSOLE LEFT         |
| 11   | PRIMARY AIR FILTERS                 | 39   | CAB SIGNAL EQUIPMENT         |
| 12   | "V" SCREENS                         | 40   | OVERHEAD CONSOLE             |
| 13   | ALTERNATOR BLOWER/EDUCTOR           | 41   | RADIO ANTENNA                |
| 14   | 7FDL16 DIESEL ENGINE                | 42   | RECTIFIERS                   |
| 15   | ENGINE MUFFLER                      | 43   | HEAD END POWER ALTERNATOR    |
| 16   | SECONDARY AIR FILTERS               | 44   | AUXILIARY ALTERNATOR         |
| 17   | OIL COOLER                          | 45   | TRACTION ALTERNATOR          |
| 18   | RADIATOR                            | 46   | TRUCK                        |
| 19   | CONTROL AREA 9 (CA9)                | 47   | BATTERIES                    |
| 20   | AIR COMPRESSOR                      | 48   | FUEL COMPARTMENT SIGHT GLASS |
| 21   | WATER TANK                          | 49   | FUEL TANK                    |
| 22   | TOOL BOX                            | 50   | RETENTION TANK               |
| 23   | RADIATOR FAN AND MOTOR              | 51   | AIR RESERVOIR                |
| 24   | TRACTION BLOWER/EDUCTOR #2, REAR    | 52   | FUEL FILL                    |
| 25   | ENGINE AIR CLEANER COMPARTMENT      | 53   | CAB SIGNAL PICKUP COIL       |
| 26   | OIL FILTER                          | 54   | EMERGENCY BRAKE VALVE        |
| 27   | HORN                                | 55   | QUALCOM COMMUNICATION        |
| 28   | TRACTION BLOWER/EDUCTOR #1, FORWARD | 56   | QUANTUM BOX                  |

FIG. 1. LOCATION OF APPARATUS. E-42563A.



## GENERAL LOCOMOTIVE DATA

|  |   |
|--|---|
| Operating Cab and Controls .....                         | Monocoque with Desktop Controller and IFC |
| Wheel Arrangement .....                                  | B-B                                       |
| <b>Engine Data:</b>                                      |   |
| Horsepower – Traction (Without HEP Load; 1050 RPM) ..... | 4250                                      |
| (Without HEP Load; 900 RPM) .....                        | 3540                                      |
| (With 800 Kw HEP Load; 900 RPM) .....                    | 2525                                      |
| Number of Cylinders .....                                | 16  |
| Model .....  | GE 7FDL16                                 |
| Bore and Stroke (in.) .....                              | 9 X 10-1/2                                |
| RPM .....  | 1050                                      |
| Compression Ratio .....                                  | 12.7:1                                    |
| Cycle .....  | 4   |
| Turbocharged .....                                       | Yes (7S1716)                              |
| Electronic Fuel Injection .....                          | Yes (Bosch)                               |
| Engine Cooling Fan .....                                 | 1   |
| Engine Cooling Fan Drive .....                           | AC Motor                                  |
| <b>Traction Equipment:</b>                               |   |
| Traction and Auxiliary Alternator .....                  | GMG 195B1                                 |
| Alternator Blower .....                                  | 1   |
| Traction Motor .....                                     | 4-GE752AH™                                |
| Traction Motor Blowers .....                             | 2   |
| Blower Drive .....                                       | AC Motor                                  |
| <b>Head End Power Equipment:</b>                         |   |
| Alternator .....   | GTA 33A1                                  |
| Rating .....   | 480 V, 60 Hz, 800 Kw                      |
| Air Brake Schedule .....                                 | NYAB/KNORR Electronic System              |
| <b>Major Dimensions (Approximate):</b>                   |   |
| Length .....   | 69 ft. 0 in.                              |
| Height .....   | 14 ft. 9 in.                              |
| Width .....  | 10 ft. 0 in.                              |
| Bolster Centers .....                                    | 43 ft. 3 in.                              |
| Truck Wheel Base .....                                   | 9 ft. 0 in.                               |
| <b>Minimum Track Curvature (radius and degrees):</b>     |   |
| For Single Unit .....                                    | 248 ft/23.1°                              |
| For MU .....   | 315 ft/18.2°                              |
| Driving Wheel Diameter (in.) .....                       | 40  |
| Weight (lbs, maximum) .....                              | 268,000                                   |
| Maximum Continuous Tractive Effort / Speed (MPH) .....   | 36,450/37.8                               |
| Gear Ratio .....   | 74/29                                     |
| Maximum Speed (mph) .....                                | 110                                       |
| <b>Supplies:</b>   |   |
| Fuel Tank (gal.) .....                                   | 2200                                      |
| Coolant (gal.) .....                                     | 380                                       |
| Lubricating Oil (gal.) .....                             | 410                                       |
| Sand (cu. ft.) .....                                     | 26  |
| <b>Compressor, Air:</b>                                  |   |
| Compressor Drive .....                                   | AC Motor                                  |
| Maximum Delivery CFM .....                               | 236                                       |
| Type of Cooling .....                                    | Air                                       |
| <b>Air Filtering Devices: Primary</b>                    |   |
| Secondary Engine Air Intake .....                        | Vortex, Self-Cleaning                     |
| Engine Room Pressurized .....                            | Fiberglass Mat (Baggie)                   |
| Main Generator Pressurized .....                         | Yes                                       |
| ™ Trademark of General Electric Co. ....                 | Yes                                       |



## LOCOMOTIVE DESCRIPTION

***NOTE: For a more in-depth discussion of the P42-DC Locomotive functional description, refer to the LOCOMOTIVE RUNNING MAINTENANCE Manual.***

The General Electric P42-DC Locomotive (Fig. 1) is a 4250 Horsepower diesel-electric locomotive designed specifically for passenger service. The locomotive is equipped with a turbocharged 16-cylinder diesel engine that develops maximum horsepower at 1050 RPM. The main alternator converts this mechanical energy into electrical energy which is distributed to the traction motors. Each of the four traction motors is directly geared to a pair of driving wheels. The gear ratio of the traction motor to the wheel axle (along with the microcomputer control system programming) determines the maximum operating speed of the locomotive. This unit has 74/29 gearing which provides a top speed of 110 MPH.

One of the new designs specifically for passenger service is the high-strength, lightweight monocoque carbody. This fully-enclosed carbody provides protected walkways for easy access to the Engine and Radiator Compartments. The monocoque carbody design permits higher horsepower with improved weight efficiency.

This locomotive is equipped with advanced microprocessor-controlled systems that promote superior propulsion performance, optimize system power management and enhance overall reliability. The microcomputer system consists of seven main microcomputers designated Cab Controller (CAB), Excitation Controller (EXC), Auxiliary Controller (AUX), Head End Power Controller (HEP), Integrated Function Computer (IFC), Electronic Air Brake (EAB), and Electronic Fuel Injection (EFI); and operator display panels called Integrated Function Display (IFD). All of the other locomotive systems depend on the microcomputer system for control.

The microcomputer system continually monitors and regulates locomotive performance and automatically makes adjustments based on operating requests and locomotive conditions. In addition, each microcomputer can provide troubleshooting diagnostics as well as a self-test capability. Each microcomputer controls a separate system as follows:

- CAB is the "Master Processor." As such, it receives operating commands from the operator and the locomotive trainline wires. CAB determines locomotive operating requests, such as motoring, dynamic braking and self-load. CAB also stores and retrieves diagnostic information and locomotive FAULT history.
- EXC receives traction system excitation control commands from CAB. EXC relays these commands to the locomotive control circuits and regulators to control locomotive auxiliary excitation and battery charging. EXC also receives excitation control system feedback signals that enable it to monitor locomotive excitation and relay/contactors drivers and to make necessary adjustments. In addition, EXC provides output signals that control the engine speed in accordance with the position of the **Combined Power** handle.
- AUX receives control commands from HEP and EXC and auxiliary control feedback signals, such as temperatures and air pressures. AUX uses these inputs to compute traction motor temperatures and radiator and traction motor blower speeds. AUX also controls the power, braking and cranking contactors as well as the braking switch, reverser and various relays. Engine cranking and radiator shutter operation are also controlled by AUX.
- HEP selects the source of Head End Power by receiving operator-selected control commands by way of switches on the HEP Control Panel and feedback/status signals from various devices. HEP controls the output of the Head End Alternator (HEA), enable/inhibits redundant battery charging, and controls the blended braking function.
- IFC gathers locomotive status data from the other microcomputers, by way of serial links, and by inputs from various other components, and then formats the data for display on the Integrated Function Displays (IFDs).

Traction alternator excitation is initiated in response to the Throttle Notch signals (controlled by the operator by manually moving the Combined Power handle or controlled by the trainline control wires) that request certain horsepower levels.



The primary functions of the traction alternator excitation control system are as follows: 1) Initiate and regulate the output voltage and current of the traction alternator; 2) Reduce power (tractive effort), when required, to provide maximum adhesion; 3) Reduce output voltage to prevent equipment damage from power circuit grounds; and, 4) Reduce output current to prevent overheating of traction motors.

The Auxiliary Power System includes the power source, the auxiliary alternator, and the electrical power loads (an alternator blower motor, an air compressor drive motor, two equipment blower motors, a radiator fan motor, a battery charging circuit, and system controls).

The auxiliary alternator is contained within the frame of the traction alternator. It has one rotating excitation field and three stationary stator windings, which have dedicated loads: 1) Excitation Supply; 2) Auxiliary Motor Supply; and, 3) Battery Charging. The Auxiliary Alternator Field Regulator (BFR) regulates excitation current in the rotating field of the auxiliary alternator.

Operation of the Primary Battery Charging System requires that the engine be running and the auxiliary alternator field be excited. The power source for charging the battery is a separate three-phase alternator winding within the auxiliary alternator. Filtering of the battery charging current is accomplished with a Crank/Charging Reactor (LS) connected between the battery negative and the SCR bridge negative. Also, part of the filter is the Control Power Filter (CPF), which is connected across the SCR bridge positive and the battery negative.

The Redundant Battery Charging System operates only when the Head End Power System is ON (normal, standby, or wayside) and the Primary Battery Charging System is OFF from a system fault or the engine is shut down (wayside). This system functions almost identical to the Primary Battery Charging System. Both systems use the same type of rectifier panel, but the Redundant Battery Charging System uses a Redundant Battery Charging Controller (RBCC) to control the SCRs in the rectifier panel (RBCP) and Redundant Battery Charging System does not change voltage with temperature changes.

The locomotive has three electrically driven blowers. The Alternator Blower is located in the Alternator and Traction Blower and Eductor Module above the main alternator. This blower cools the Traction and Auxiliary Alternators, the power rectifier panels and the electrical control equipment. This blower operates at a constant ratio of diesel engine speed.

Traction Motor Blower #1 is located in the Alternator and Traction Blower and Eductor Module ahead of the alternator blower. This blower provides cooling air for the Traction Motors at the front end of the locomotive and the Head-End Power Alternator. Traction Motor Blower #2 is located in the Radiator Compartment of the locomotive. This blower provides cooling air for the Traction Motors at the rear end of the locomotive. Both traction motor blowers are controlled by a single solid-state regulator which varies the speed of both blowers together.

The engine air cleaning system is located between the engine compartment and the radiator compartment. Outside air enters through "vee" screen air inlets and primary plastic air cleaners identical to the equipment air cleaners. The engine air cleaners are located above the walkways on both sides of the locomotive. Cleaned air is collected inside the engine air cleaner compartment. It is drawn through secondary air filters to the inlet of the turbocharger, then under pressure to the engine inlet manifolds.



## LOCOMOTIVE OPERATION DESCRIPTION

Starting the engine requires battery power be provided to the control, fuel pump motor and cranking circuits. When the Engine Start Switch (EST) is moved to the PRIME position, battery voltage is applied to the Fuel Pump Relay (FPR). The FPR connects the Fuel Pump Motor (FPM) and completes the power circuit. The Fuel Pump Motor starts and pressurizes the fuel lines to the fuel injectors.

When the Engine Start Switch (EST) and Engine Control (EC) switches are moved to the START position, battery voltage is applied to Engine Crank Positive Contactor (GS+) and Engine Crank Connection Contactor (GSC). Once the circuit is completed, the traction alternator is used as a large synchronous AC motor to crank the diesel engine.

The cylinders will fire when the engine is cranked. The diesel engine crankshaft is mechanically coupled to the traction alternator rotor. As the rotor turns, it converts engine mechanical energy into three-phase VAC. This VAC is fed to the power rectifiers where it is rectified to VDC. The VDC flows through power contactors, a Reverser and Braking switch to the traction motors. The traction motors are mechanically connected to the wheels through reduction gearing. The VDC applied to the traction motors causes the traction motors to rotate. The wheels then are turned through the reduction gearing.

This locomotive uses an excitation control system called "Micro-CHEC." This is a microcomputer controlled constant horsepower type of excitation system. Traction alternator excitation is initiated in response to the Throttle Notch signals (controlled by the operator by manually moving the **Combined Power** handle or controlled by the train-line control wires) that request certain horsepower levels. The electrical capacity of the alternator and its excitation control system eliminates the need for traction motor or alternator transition (traction motor or alternator circuit reconnection from parallel to series or series-parallel). This is normally a required speed event on other locomotives for operating over the complete locomotive speed range.

The locomotive Adhesion Control System, referred to as "Micro-Sentry," is a traction motor speed regulating control system. That is, it monitors the speed of each traction motor and attempts to regulate the maximum differential between axle speeds within an allowable limit. To do this, the speed of each traction motor armature is measured with a magnetic Speed Sensor (SS). Each sensor is magnetically pulsed as the teeth of special 60-tooth gear, mounted on the commutator end of the traction motor, pass through the sensor's magnetic field. The AC pulse train signals from each speed sensor are fed directly to the EXC Controller where they are used to indicate the speed of each axle.

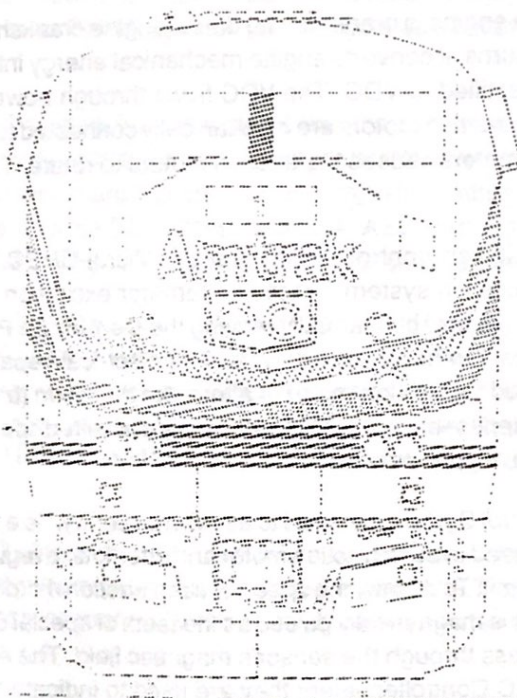
The speed sensor signals are automatically calibrated to compensate for differences in wheel diameters because of wear. When this automatic calibration procedure takes place, the EXC Controller uses the No. 2 traction motor as the reference axle and adjusts stored values of gain for each of the other axles so that all axles appear to have the same speed. A series of computational steps (or algorithms) within the Adhesion Control System provide for the detection of wheel slips and applies an appropriate corrective action when required. Typical responses include automatic sanding, variable power reduction, and a trainlined wheel slip indication.

The purpose of the Head End Power System is to provide 480 VAC, 3-phase, 800 KW, 60 Hz power for train use. This VAC power can be obtained from one of three sources:

1. In **Normal mode**, from the Head End Alternator (HEA) – the engine, at 900 RPM, has 3650 HP available for combined head-end, auxiliary, and traction power,
2. In **Standby mode**, from the Traction Alternator (TA) – the engine set at 716–723 RPM with no traction power available,
3. In **Wayside mode**, from a HEP Receptacle located at the front or rear of the locomotive.

The operator selects which source the Head End Power is obtained from by way of a switch on the HEP Control Panel. Control signals are sent to the HEP Controller, which energizes the proper switches/contactors.







## CAB EQUIPMENT

### INTRODUCTION

This section of the operating manual identifies and describes the devices located in the cab needed by the engineer to control the locomotive.

All devices, manual and visual, required by the engineer to set-up and operate the locomotive are located near the engineer's position. Most of the devices are located on the Control Consoles (Figs. 5 and 7) and the Engine Control panel (Fig. 12).

This section also gives an overview of the Integrated Function Control supplied on the *P42-DC Locomotive*. For specific control procedures and display screens (e.g., CAB SIGNAL), refer to the appropriate following sections of this manual. If any abnormal operating situations occur, refer to the **TROUBLESHOOTING** section of this manual.

### THE INTEGRATED FUNCTION CONTROL SYSTEM

#### General Information

The *Integrated Function Control system* (Fig. 2) is divided into two major parts: the Integrated Function Computer (IFC) and the Integrated Function Displays (IFD). This system is used to integrate third party systems into the GE control system.

Along with the integrated control system, this locomotive is equipped with Electronic Air Brakes. The *Electronic Air Brake system* is divided into two main groups: the brake handles or controllers (Independent and Automatic) and the NYAB/KNORR PNEUMATIC CONTROL UNIT (PCU) found in the air brake compartment.

The goals of this new control integration system are:

1. Provide the operator with more useful functional information.
2. Reduce clutter in the operating cab through the elimination of bolt-on boxes and redundant displays.
3. Improve equipment reliability through reduction of parts and connections.

### Integrated Function Control (IFC)

The IFC is the communications center for all on-board locomotive control functions. The basic IFC function is to communicate data among the various on-board locomotive control functions such as:

1. Alerter control [and Audio/Visual Alarm Box (AVB)] systems located in the IFC system.
2. CAB, EXC, AUX and HEP controllers.
3. IFDs mounted on Control Consoles Right and Left.
4. Event Recorder – consisting of two parts: Permanent Core Memory (PCM) and Customized Recording Device (CRD) – data may be downloaded to a removable memory card.
5. End of Train (EOT) information through the Receiver Logic Unit (RLU).
6. Electronic Air Brake Control System.
7. Fuel Monitoring, Cab Signal, Horn Sequencer and Overspeed Functions.
8. Electronic Fuel Injection.

### Integrated Function Display (IFD)

The new Integrated Function Control System utilizes three IFDs (two located on the control console right; one on the control console left) which are fed information over a data link from the IFC and feed operator commands to the IFC. Each IFD is a ten-inch diagonal, back-lighted, color graphics liquid crystal display (LCD) with up to eight menu soft keys arranged horizontally below the screen. Background color is black. Screen colors have been chosen to attract the operator's attention: YELLOW for alarm or out-of-limit condition, RED for danger; BLUE, YELLOW and GREEN for bar graphs. Brightness is manually controlled to adjust for day, night or tunnel operation. In addition, 30 continuous minutes of operator inactivity will cause all displays to shut down (pressing any display key or alerter reset will restore operating brightness).



**NOTE:** Each IFD has its own independent distance counter.

### Operator's Display

This screen (Item 1, Fig. 5) replaces the former analog speedometer, ammeter, air and pressure gauges mounted on the control console. The Operation Screen also replaces the functional controls and displays of the bolt-on boxes covering End Of Train, Alerter and Cab Signal Systems. The screen will show both analog and digital readouts of Speed, Load and air pressure data. The air pressure data covers Main Reservoir, Equalizing Reservoir, Brake Pipe, Brake Cylinder, End of Train and Brake-Pipe Reduction. Digital readouts of fuel remaining, cruise set speed and HEP volts/amps are centrally located.

This screen also displays Cab Signal function status

lights (OVER SPEED, SUPPRESSION, CUT OUT and SELF TEST) and the annunciator lights for SLIP/AXLE WARN, PCS OPEN, SAND, DYNAMIC BRAKE, PENALTY BRAKE, ALERTER CUT OUT, OVR SPD CUT OUT, EOT COMM, EOT LOW AIR, EOT VALVE, EOT BATTERY and CAB SIGNAL CUTOFF. See the appropriate following sections of this manual for more information.

### Crew Member's Display

This IFD, mounted on control console left (Crew Member's), is used to monitor locomotive performance.

**Note:** No locomotive operating controls are available at this display.

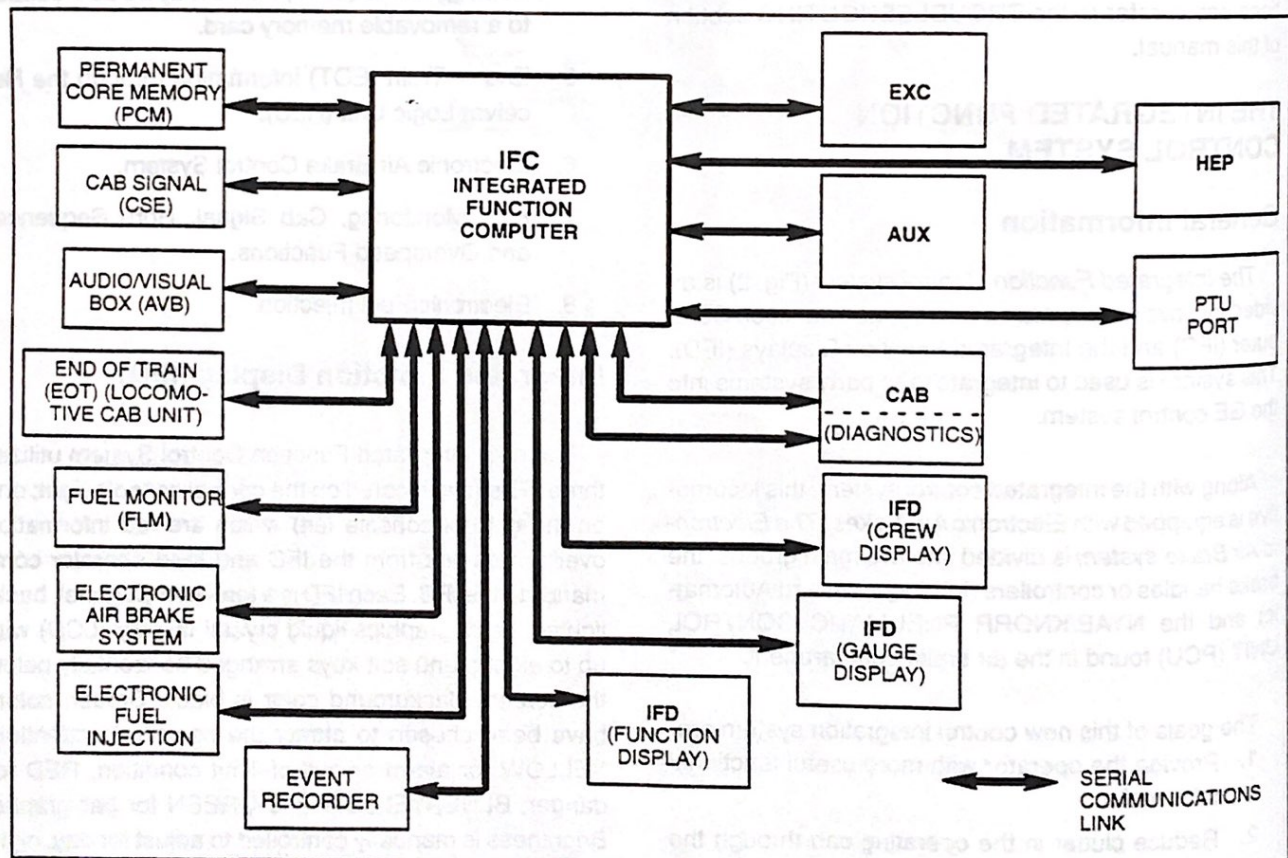


FIG. 2. INTEGRATED FUNCTION CONTROL SYSTEM OVERVIEW. E-42578.



## DEVICES IN NOSE COMPARTMENT

**NOTE:** Numbers in parentheses ( ) refer to Items found on Figure 3 of this publication unless noted otherwise.

### Sand Control System

Sand traps are mounted under each sand box in the corners of the nose cab and radiator compartments. Sand flows from the sand boxes to the traps by gravity. When a Sand signal is given, the lead axle sander control valves (3) operate to allow compressed air to flow to the sand traps. The air fluffs the sand and carries it out through the sanding hose to the rail.

**Note:** Manual sanding is NOT available above seven (7) MPH, except lead axle sand.

### Qualcom Satellite System

This satellite system allows for continuous communication among train operators, customer service centers, mechanical divisions, data centers, and commis-

saries. The system enables constant monitoring of the status and position of trains. The satellite system consists of a Communication Unit (1), Display Unit (Item 8, Fig. 7), and roof mounted antenna. Directly to the left of the Qualcom communication unit is the Qualcom circuit breaker (2).

## DEVICES ON CAB FLOOR

**NOTE:** Numbers in parentheses ( ) refer to Items found on Figure 3 of this publication unless noted otherwise.

### Floor Lighting

Four lights (6) provide the floor lighting. Use the Cab Floor Lighting Switch (Item 6, Fig. 7) located on the Center Console to turn on or off.

### Fire Extinguishers

Two fire extinguishers (5) are located in the operator's cab. One is behind the Engineer's seat, while the other is behind the Helper's seat. There is also a fire extinguisher in the Engine compartment and one in the Radiator compartment.

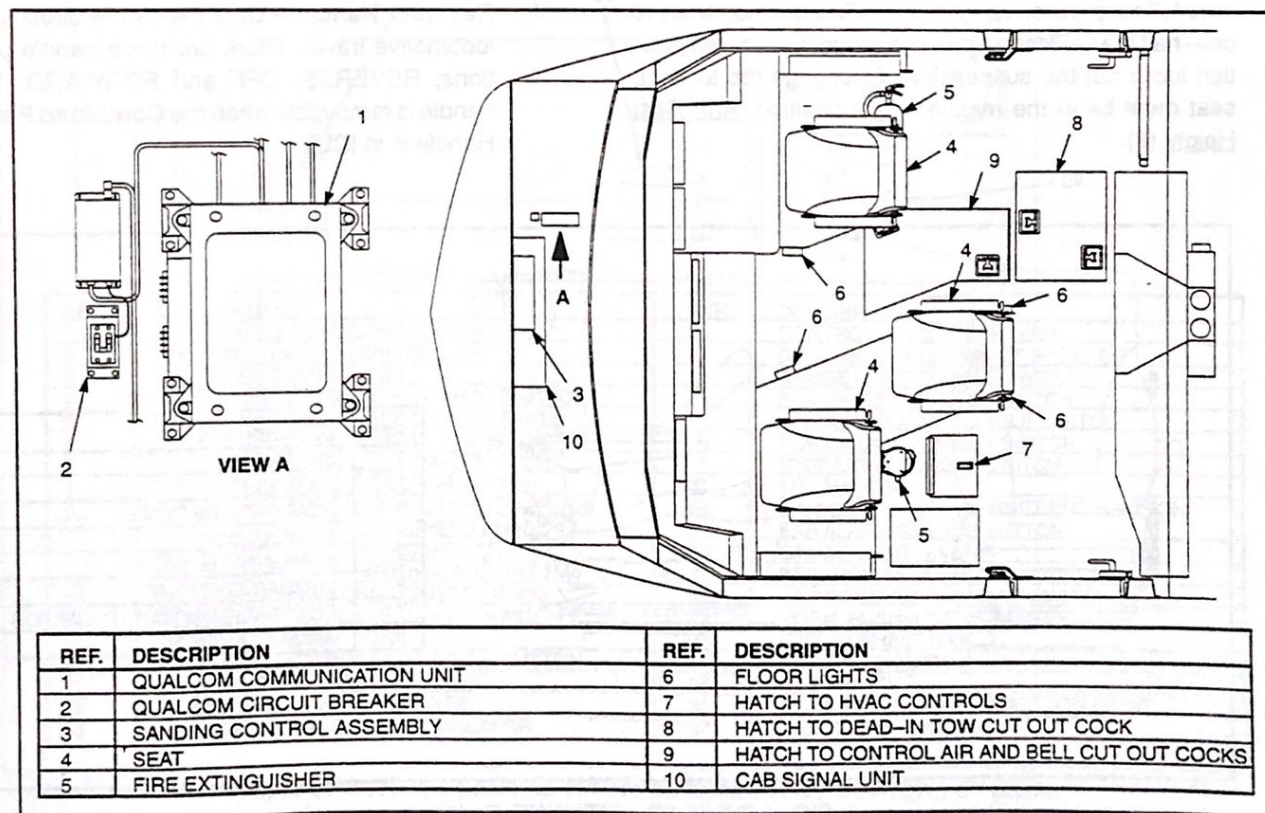


FIG. 3. OPERATING COMPARTMENT EQUIPMENT, NOSE AND FLOOR. E-42714.



## HVAC Damper Access

This hatch (7) provides access to fresh air dampers.

## Dead-In-Tow Cut-Out Cock Access

This hatch (8) provides access to the dead-in-tow cut out cock (Item 1, Fig. 18).

## Control Air and Bell Cut-Out Cock Access

This hatch (9) provides access to the control air (Item 1, Fig. 32) and bell cut-out (Item 2, Fig. 32) cocks.

## Seating

Three seats (4), engineer, helper and center positions, are provided in the operator's cab. Each seat is adjustable as follows (refer to Fig. 4): Seat Height (1) increases while turning knob forward. Lifting weight off seat makes adjustment easier. Seat Tilt (2). Seat Back Recline (3). Swivel Lock (4). Fore/Aft Slide (5) adjusts by raising handle. Lumbar Support (6). Suspension Lockout/Limitor (7) has three positions. The right position allows full suspension range. The middle position limits to one-half the vertical suspension range, and the left position locks out the suspension. To engage the lockout, seat must be in the middle height position. Arm Rest Height (8).

## DEVICES ON CONTROL CONSOLE RIGHT (Engineer's Position)

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 5 of this publication unless noted otherwise.

The following operating devices are located on the control console:

### Integrated Function Display (IFD)

Two IFDs (1) are located on the Control Console Right (Fig. 5). One is used to monitor locomotive performance and perform diagnostic testing, while the other replaces the former analog gauges.

### 17KC120D Master Controller

The 17KC120D Master Controller (2, and also shown in Fig. 6 viewed from front of console), is a two-handle, manually operated, controller used by the engineer to regulate locomotive power, dynamic braking and direction. The two handles are the **Reverser** and the **Combined Power** (Power Notches, Idle, Dynamic Brake), and their functions are as follows:

1. **Reverser Handle** – Determines the direction of locomotive travel. There are three handle positions; REVERSE, OFF and FORWARD. This handle is removable when the **Combined Power** Handle is in IDLE.

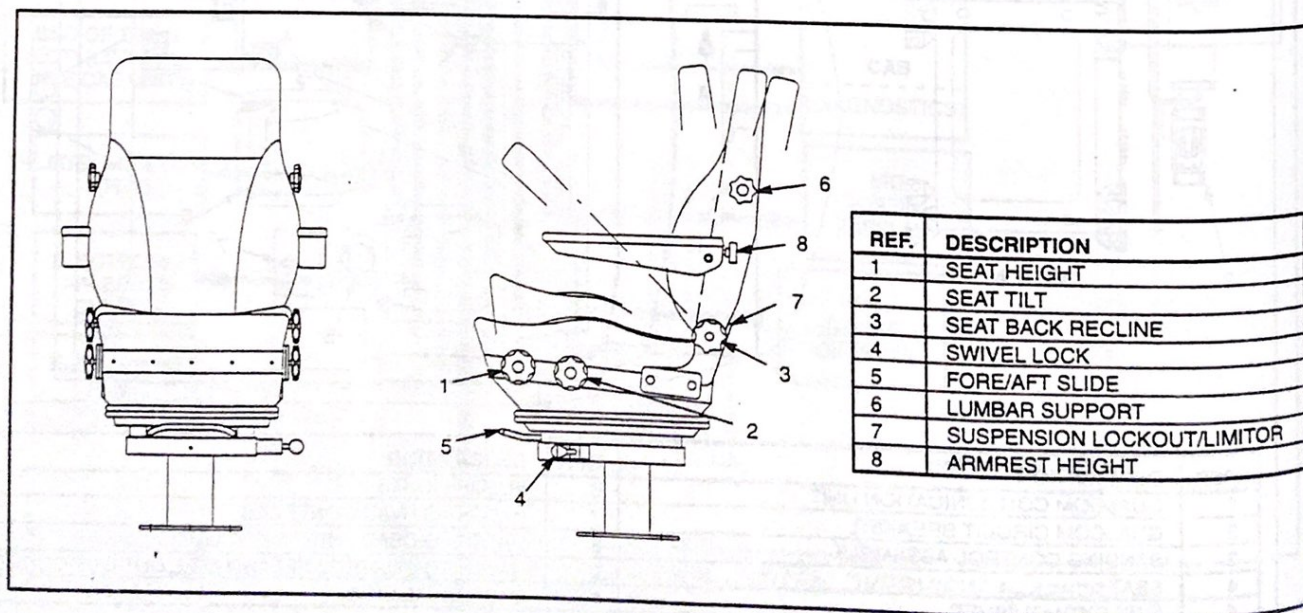


FIG. 4. SEAT ADJUSTMENT. E-42715.



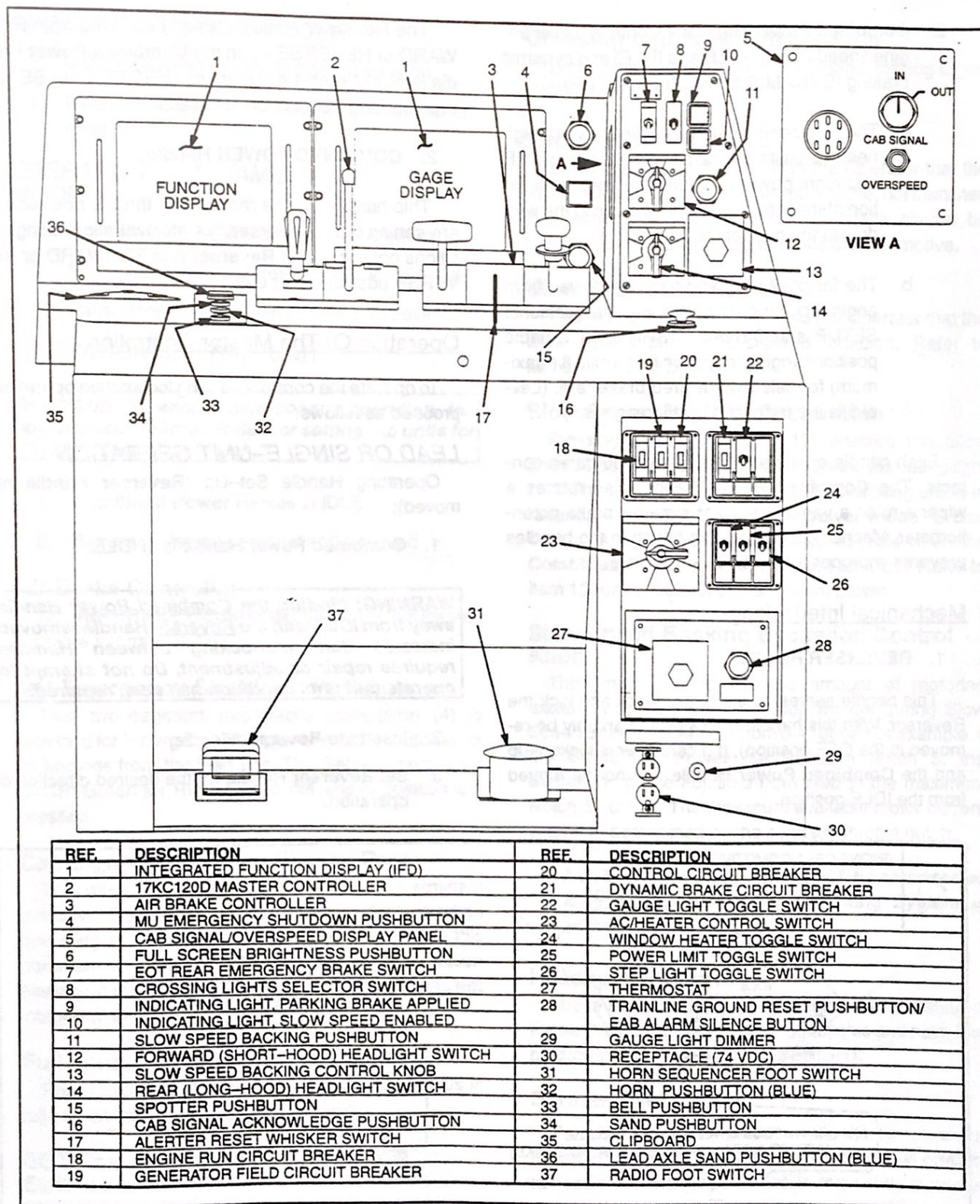


FIG. 5. CONTROL CONSOLE RIGHT (ENGINEER'S POSITION). E-42564.



2. **Combined Power Handle** – Controls diesel engine speed (THROTTLE and IDLE) and dynamic braking (DYNAMIC BRAKE and SETUP).

- a. The near position (handle pulled toward engineer) consists of nine handle positions: IDLE and eight power positions "notches." Indication of the throttle position is given in the window to the right of the handle.
- b. The far position (handle pushed away from engineer) consists of two handle positions: SETUP and DYNAMIC BRAKE; a variable position ranging from 1 (minimum) to 8 (maximum) for selecting desired brake rate. (Level 8 is the farthest from the engineer.)

Each handle opens and closes cam-operated contacts. The **Combined Power** Handle also rotates a wiper arm on a variable resistor dynamic brake potentiometer. Mechanical interlocking between the handles prevents improper operation of any handle.

### Mechanical Interlocking

#### 1. **REVERSER** Handle:

This handle serves as a key to unlock and lock the Reverser. With this handle removed, (it can only be removed in the OFF position), the controller is locked-up and the **Combined Power** Handle can not be moved from the IDLE position.

The **Reverser** Handle cannot be moved from FORWARD or REVERSE when the **Combined Power** Handle is in: a) Notch 1 or higher of THROTTLE, b) SETUP or c) braking range of DYNAMIC BRAKE.

#### 2. **COMBINED POWER** Handle:

This handle can be moved into throttle positions at any setting of the **Reverser**, but into dynamic braking positions only when the **Reverser** is in FORWARD or REVERSE positions (not OFF).

### Operation Of The Master Controller

To operate the controller during locomotive operation, proceed as follows:

#### **LEAD OR SINGLE-UNIT OPERATION**

Operating Handle Set-Up (**Reverser** Handle removed):

1. **Combined Power** Handle is in IDLE.

**WARNING:** Finding the Combined Power Handle away from IDLE with the Reverser Handle removed indicates that interlocking between Handles requires repair or adjustment. Do not attempt to operate unit until condition has been repaired.

2. Insert the **Reverser** Handle.
3. Set **Reverser** Handle for the desired direction of operation.

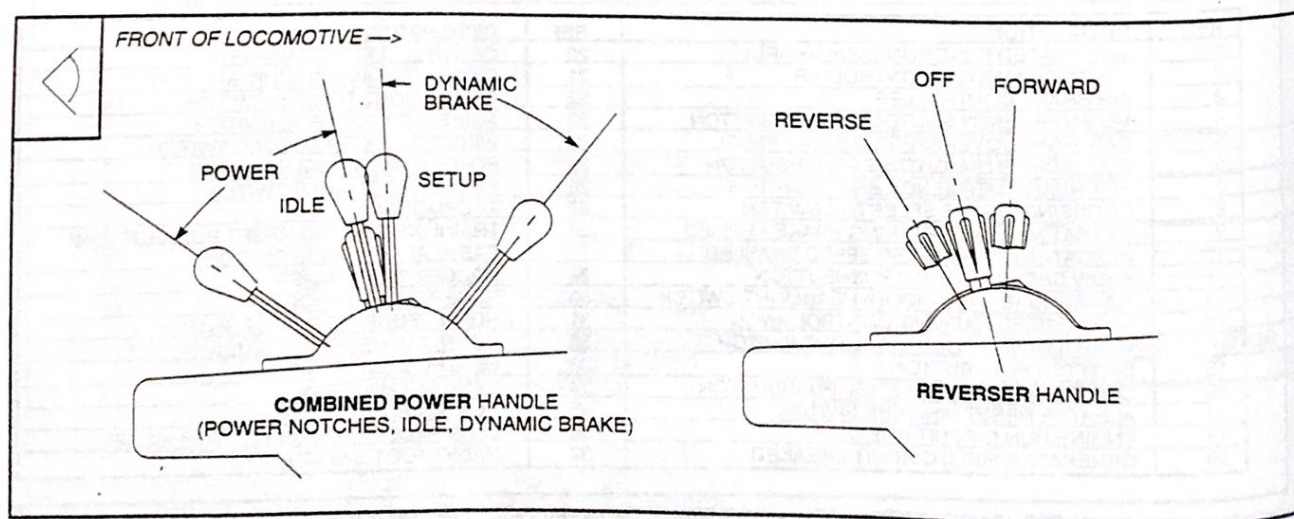


FIG. 6. MASTER CONTROLLER HANDLE POSITIONS. E-38330D.



## OPERATING IN POWER MODE

1. Move **Reverser** Handle to desired position.
2. Move the **Combined Power** Handle to the desired notch.

## OPERATION IN DYNAMIC BRAKE MODE

1. Move **Reverser** Handle to desired position.
2. Move the **Combined Power** Handle to SETUP.
3. Pause momentarily, then advance as desired.

## OPERATION AS TRAIL UNIT

**WARNING:** To ensure safe consist operation, follow specific Railroad Rules for setting-up units for "Trail," "Dead," or "Push."

1. **Combined Power** Handle in IDLE.
2. **Reverser** Handle centered and removed.

## Air Brake Controller

See **AIR BRAKE EQUIPMENT** section of this manual for more information (3).

## MU Emergency Shutdown Pushbutton

This two-segment (red/green) pushbutton (4) is provided for Emergency Multiple-Unit (MU) shutdown of all engines from the lead unit. The Red segment is for STOP; Green for RUN. Button remains in position last pressed.

## Cab Signal/Overspeed Display Panel

This display panel (5) is used for IITS (Intermittent Inductive Train Stop) and Cab Signal system when operating on Railroads so equipped. Mounted on this panel are the TERRITORY IN/OUT switch, the Sonalert alarm and the Overspeed light. The IITS system is **not** integrated in the IFC system.

## Full Screen Brightness Pushbutton

Pressing this pushbutton (6) brings all three IFDs to full screen brightness after four seconds.

## EOT Rear Emergency Brake Toggle Switch

Pressing this spring-loaded toggle switch (7) initiates an End Of Train Emergency Brake Application as indicated on the IFD if two-way EOT is in use

## Crossing Lights Selector Switch

This toggle switch (8) turns the Road Crossing Lights ON/OFF.

## Parking Brake Applied Light

This indicating light (9) notifies the Operator that the parking brake is applied on this locomotive, not trainlined from other units, and the parking brake should be released before attempting to move the locomotive.

## Slow Speed Enabled Light

This indicating light (10) notifies the Operator that the Slow Speed backing system is enabled. Refer to Items 11 and 13 below.

## Slow Speed Backing Pushbutton

Pressing this pushbutton (11) enables the Slow Speed Backing System and turns ON the indicating light (10). The system will only enable if: controlling unit is in **reverse**; controlling unit is in a **power mode**; Cruise Control is **OFF**. The system will de-activate when the **Combined Power** handle is moved to IDLE. Refer to Item 13 for the control of the system power.

## Slow Speed Backing Excitation Control Knob

This knob (13) adjusts the amount of motoring excitation applied to the traction motors during Slow Speed Backing operation from 0 – 100%. For example, if the **Combined Power** handle is in Notch 3, the excitation can be adjusted from zero to the maximum Notch 3 current. The maximum available motor current is always determined by the selected throttle notch.

**NOTE:** Cruise Control may **NOT** be activated as long as the Slow Speed Backing System is active.

## Headlight Switches

These switches (12 and 14) control the operation of the short-hood and long-hood headlights and have four positions; OFF, DIM, MED and BRIGHT.

## Spotter Pushbutton

Pressing this button (15) activates the spotter circuit (when EC switch is in JOG). The spotter circuit enables railroad maintenance personnel to move the locomotive using battery power. The traction motors are powered only while the button is pressed. The reverser sets direction.



## Cab Signal Acknowledge Pushbutton

This pushbutton (16) is used to acknowledge downward signal aspect changes of the Cab Signal system and IITS warnings. It also resets the Alerter. See **SAFETY DEVICES** section of this publication for more information.

## Alerter Reset Whisker Switch

This whisker switch (17) manually resets the Alerter. This switch must be activated at set time intervals or a penalty brake application will occur. See appropriate paragraph of the **SAFETY DEVICES** section of this publication for more information.

## Engine Run Circuit Breaker

This breaker (18) controls engine speed. It must be ON in lead unit and OFF in other units of the consist to control engine speed through the throttle speed and engine run trainlines. When breaker is tripped, engine will not power above Notch one. On Trail/Push locomotives, it should be in the OFF position.

## Generator Field Circuit Breaker

The Generator Field circuit breaker (19) is ON whenever the locomotive is powered and operating as a Lead unit. The breaker may be turned OFF to keep the traction alternator de-energized when it is necessary to run the engine at speeds higher than IDLE. On Trail/Push locomotives, it should be in the OFF position.

## Control Circuit Breaker

The Control breaker (20) provides power to the trainline control positive wire (T/L 13) and other circuits, including the alarm bell. In MU operation, this breaker must be ON on the Lead unit; OFF in Trail units. In Push Mode, it must be ON.

## Dynamic Braking Control Breaker

The Dynamic Braking Control breaker (21) is used to control the dynamic braking of the locomotive. In MU operation, this breaker must be ON on the Lead unit (OFF on Trail units) to control the dynamic braking of other units in the consist.

## Gauge Light Switch

This toggle switch (22) turns on the engineer's console gauge lights.

## Air Conditioner And Heater Control Switch

This under-floor mounted air conditioning/heating unit provides ventilation and thermostatically controlled heating and cooling. When the unit is operating, it provides forced fresh air into the cab, as well as providing conditioned air to the toilet room. It is also de-mists the windshields. The unit only operates when HEP is on the locomotive, whether generated locally, or remotely. The unit is controlled by an adjustable thermostat (27), and a rotary mode selector switch (23).

A fresh air damper is provided (Fig. 3) to allow fresh air supply into the cab to be shut off in extreme weather, or during an HVAC malfunction. The damper should normally be left open to provide fresh air to the cab and toilet room. The HVAC unit also provides cab pressurization.

Power is provided to the HVAC unit from a circuit breaker located in the assistant's side of the CA1 cabinet. A circuit breaker is also provided inside the unit to shutdown heater operation in case of an internal failure.

The Air Conditioner and Heater Control Switch (23) has eight positions as follows:

|                  |   |
|------------------|---|
| <b>OFF</b>       | Shuts off the Air Conditioner and Heater unit.  |
| <b>LOW FAN</b>   | Provides air circulation at LOW fan speed.      |
| <b>HIGH FAN</b>  | Provides air circulation at HIGH fan speed.     |
| <b>LOW HEAT</b>  | Provides low heat at low fan speed.             |
| <b>MED HEAT</b>  | Provides medium heat at high fan speed.         |
| <b>HIGH HEAT</b> | Provides maximum heat at high fan speed.        |
| <b>LOW COOL</b>  | Provides low cooling air at low fan speed.      |
| <b>HIGH COOL</b> | Provides maximum cooling air at high fan speed. |

**NOTE:** The Heater/Air Conditioner Circuit Breaker (Item 13, Fig. 13) must be ON to operate Air Conditioner and Heater. HEP must be ON also.

## Window Heater Switch

This toggle switch (24) turns the front window heaters ON/OFF when the Window Heater Circuit Breaker, located on the EC Panel, is ON.



## Power Limit Switch

This switch (25) has two positions, NORMAL and NOTCH 7. When the locomotive consist is in Notch 8 and the lead unit is slipping excessively, the Power Limit switch can be moved to NOTCH 7 to reduce power while the trailing units are operating at full power. This will reduce the tractive effort on the lead unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

**NOTE:** Unless directed otherwise by railroad regulations, ensure the Power Limit switch is in NORMAL position on ALL units before operating the train.

## Step Light Switch

This switch (26) turns on all step lights.

## Thermostat Control Knob

This knob (27) controls the temperature of the air exiting the under-floor air conditioner/heater.

## Trainline Ground Reset Pushbutton

This pushbutton (28) is used to reset the Ground Relay on locomotives equipped for trainline ground reset and to silence Electronic Air Brake alarms on units equipped with Electronic Air Brake system. Refer to TROUBLESHOOTING Section.

## Gauge Light Dimmer Knob

The dimmer (29) knob is used to brighten and dim the console gauge lights.

## 74 VDC Receptacle

This receptacle (30) is supplied from the 74 VDC Battery circuit.

## Radio Foot Switch

The Radio Foot Switch (37) allows hands-free operation of the radio. Depressing the foot switch keys the radio for the engineer's head set only. To use hand set, button on hand set must be held in.

## Bell and Horn Operation

### Horn Operation

A Horn pushbutton is located on the control console right (32) and on the control (Crew Member's) console left (Item 4, Fig. 8). The pushbutton has two momentary positions: half-way produces half horn decibels; all-the-way produces full horn decibels. The locomotive horn will sound as long as the horn pushbutton is depressed. The locomotive horn is interlocked with the bell

so that the bell will sound when the horn sounds. It is necessary to depress the bell pushbutton to silence the bell when it has been energized by this horn interlock.

### Bell Operation

Pressing the Bell pushbutton (33) causes the locomotive bell to sound. Pressing the bell pushbutton again will silence the bell. The locomotive bell is interlocked with the horn so that the bell will sound when the horn sounds. It is necessary to depress and release the bell pushbutton to silence the bell when it has been energized by the horn interlock.

### Horn and Bell Crossing Grade Sequencer

The horn sequencer function is integrated into the IFC system and is not operational if the locomotive speed is below 0.5 mph. Depressing the horn sequencer foot switch (31), located in the engineer's foot well (right side), will sound the locomotive horn in a sequence of long, long, short, long blasts. The locomotive bell will also be sounded when the foot switch is depressed. Pressing the foot switch again, or pressing one of the horn pushbuttons, will silence the horn. Pressing the bell pushbutton will silence the locomotive bell.

The horn is interlocked with the Road Crossing lights. When the horn is sounded, the Road Crossing lights automatically start pulsing alternately. The pulse rate is approximately 60 pulses per minute. When the horn ceases to sound, the Road Crossing lights will continue to pulse for 30 additional seconds then return to their original mode.

### Sand Pushbutton

Pressing this button (34) applies sand to the rail in front of the leading axle of all units when locomotive speed is less than seven mph. Above seven mph, manual sanding is not available. Lead Axle Sand pushbutton (36) will still function normally.

### Lead Axle Sand Pushbutton

Pressing this button (36) applies sand to the rail in front of the leading axle, depending on locomotive direction, regardless of speed.



## DEVICES ON CENTER CONTROL CONSOLE

*NOTE: Numbers in parentheses ( ) refer to items found on Figure 7 of this publication unless noted otherwise.*

### Emergency Brake Valve Pushbutton

The emergency brake valve pushbutton (1) is located on the center console. Pushing this pushbutton causes an Emergency brake application. **Pull the pushbutton out to reset.**

### Head End Power Control Panel

The operator uses the HEP Control Panel (2) to select the source of head end power. Refer to **HEAD END POWER** section.

### Aspect Display

This display (3) indicates the correct Cab Signal Aspect as received from the track. This display is mounted above the center console. Located on top of the display is a switch to select which Cab Signal system the unit is operating in: RF&P, CONRAIL, AMTRAK, ICG, UP and CUTOUT. Refer to CAB SIGNAL section of this operating manual for more information.

### Two-Way Radio

Two-way communications radio (4) operates on an FM band. Hand held telephone-style handset (5) is mounted on the Control Console. Depressing the Radio Foot Switch (Item 37, Fig. 5) allows Engineer's headset to key radio. The radio operates at either 74V from the locomotive battery or 12V from the radio battery located in the nose compartment.

### Cab Floor Lighting Switch

This toggle switch (6) turns the operating compartment floor level night lighting ON/OFF. Floor level lights are strategically placed at points where the floor height changes.

### Cab Dome Light Switch

This toggle switch (7) turns the operating compartment dome light ON/OFF.

### Qualcomm Display Unit

See Qualcomm Satellite System section page 11.

## DEVICES ON CONTROL CONSOLE LEFT (Crew Member's Area)

*NOTE: Numbers in parentheses ( ) refer to items found on Figure 8 of this publication unless noted otherwise.*

### Receptacle

This 120 VAC receptacle (1) has been provided for general use (HEP must be ON).

### Radio Telephone-Style Handset

A hand held telephone-style handset (2) is mounted on this console for crew member use.

### Headset Station

This station (3) gives the Crew Member access to the intercom and radio system. Intercom communication is immediately available when headset jack is plugged in. A Push-To-Talk (PTT) pushbutton permits two-way radio communication. A headset jack and volume control are also included.

### Horn Pushbutton

For definition of this pushbutton (4), see **Bell and Horn Operation**, Page 17.

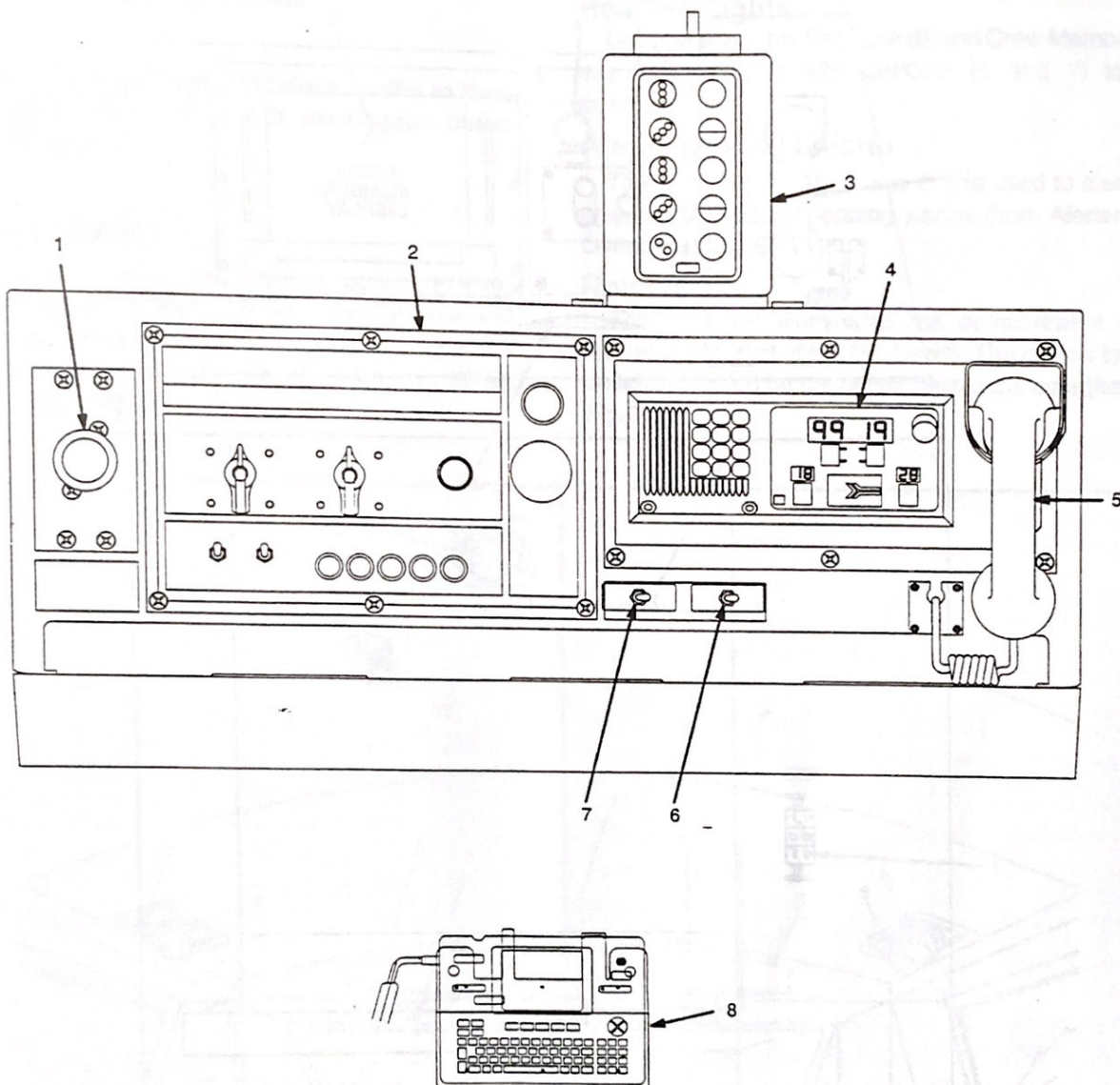
### Integrated Function Display (IFD), Crew Display

This IFD (5) is a ten-inch diagonal, backlit, liquid crystal display (LCD) is the same as found on the Control Console Right (Fig. 5). It may be used to monitor locomotive performance and perform diagnostic testing.

### Receptacles

These devices (7 and 8) are supplied to enable maintenance personnel to down-load pertinent locomotive data to a non-volatile removable memory card or personal computer.





| REF. | DESCRIPTION                                |
|------|--|
| 1    | EMERGENCY BRAKE VALVE PUSHBUTTON (RED)     |
| 2    | HEAD END POWER CONTROL PANEL               |
| 3    | ASPECT DISPLAY UNIT                        |
| 4    | RADIO                                      |
| 5    | RADIO TELEPHONE-STYLE HANDSET              |
| 6    | OPERATING CAB FLOOR LIGHTING TOGGLE SWITCH |
| 7    | OPERATING CAB DOME LIGHT TOGGLE SWITCH     |
| 8    | QUALCOM DISPLAY UNIT                       |

FIG. 7. CONTROL CONSOLE CENTER. E-42567.



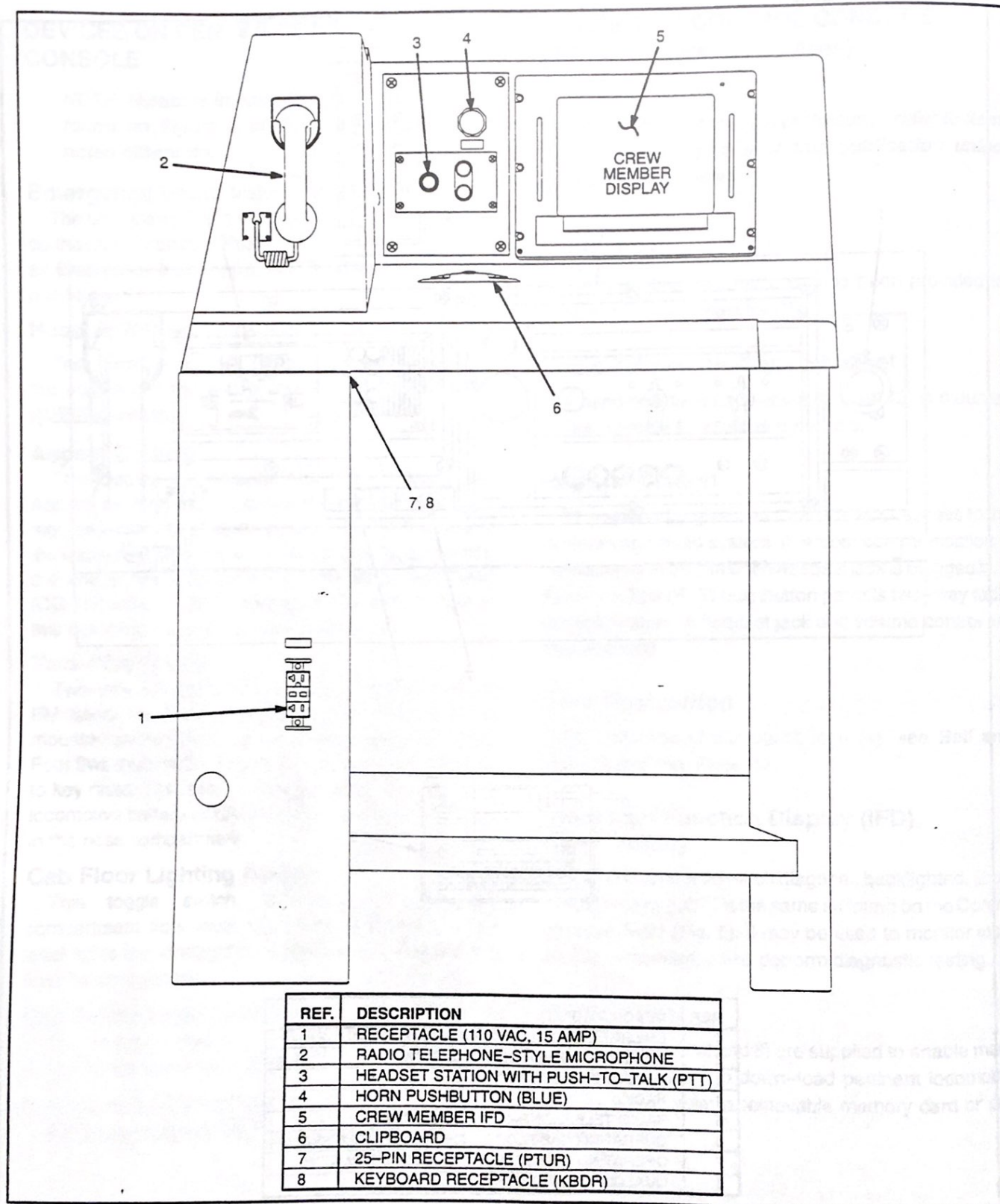


FIG. 8. CONTROL CONSOLE LEFT (CREW MEMBER'S POSITION). E-42568.



## DEVICES ON CAB CEILING

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 9 of this publication unless noted otherwise.

### Console Lights

On the bottom side of the overhead console is a light (1) for Engineer's Control Console area. A switch (2) turns the light on, a dimmer controls the brightness of the light. Also on the overhead console are a light (3) and controls (4) for the Crew Member's area.

### Reading Lights

Located above the Engineer (6) and Crew Member (8) are reading lights with ON/OFF (5 and 7) toggle switches.

### Alerter Box And Alarm

The Audio Visual Alarm Box (11) is used to alert the operator of various operating alarms (from Alserter and Overspeed and EOT).

### Dome Light

This light (9) illuminates the compartment area (especially in front of the EC Panel). The control toggle switch is located on the center control console (Item 7, Fig. 7).

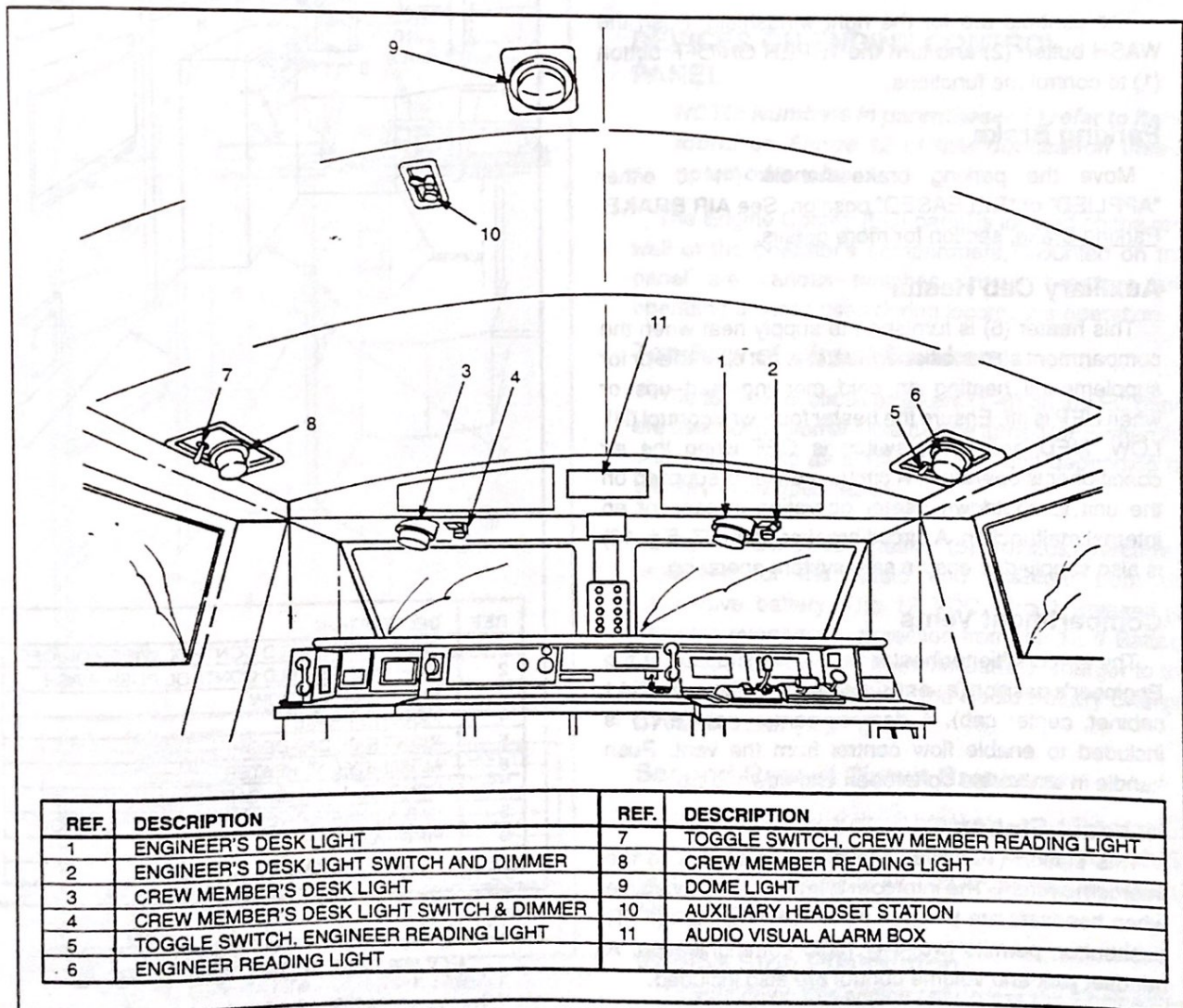


FIG. 9. OPERATING COMPARTMENT CEILING DEVICES. E-42717.



## Headset Station

This station (10) gives the crew member access to the intercom system. The intercom is immediately available when headsets are plugged in. A Push-To-Talk (PTT) pushbutton permits two-way radio communication. A headset jack and volume control are also included.

## DEVICES ON CAB RIGHT SIDE

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 10 of this publication unless noted otherwise.

### Windshield Wiper Operating Controls

The controls are for the right windshield. Push the WASH button (2) and turn the WIPER ON/OFF button (1) to control the functions.

### Parking Brake

Move the parking brake handle (4) to either "APPLIED" or "RELEASED" position. See **AIR BRAKE. Parking Brake**, section for more details.

### Auxiliary Cab Heater

This heater (6) is furnished to supply heat when the compartment air conditioner/heater is not operable or for supplemental heating on cold morning start-ups or when HEP is off. Ensure the heater four-way control (HI, LOW, MED and OFF) switch is OFF when the air conditioner is operating. A circuit breaker is supplied on the unit to shutdown heater operation in case of an internal malfunction. A circuit breaker (Item 37, Fig. 12) is also supplied to ensure safe system operation.

### Compartment Vents

The air conditioner/heater vent (8) is supplied at the Engineer's position (a vent is also located above the CA1 cabinet, center cab). A damper control handle (7) is included to enable flow control from the vent. Push handle in and rotate up to open and down to close.

## Headset Station

This station (10) gives the operator access to the intercom system. The intercom is immediately available when headsets are plugged in. A Push-To-Talk (PTT) pushbutton permits two-way radio communication. A headset jack and volume control are also included.

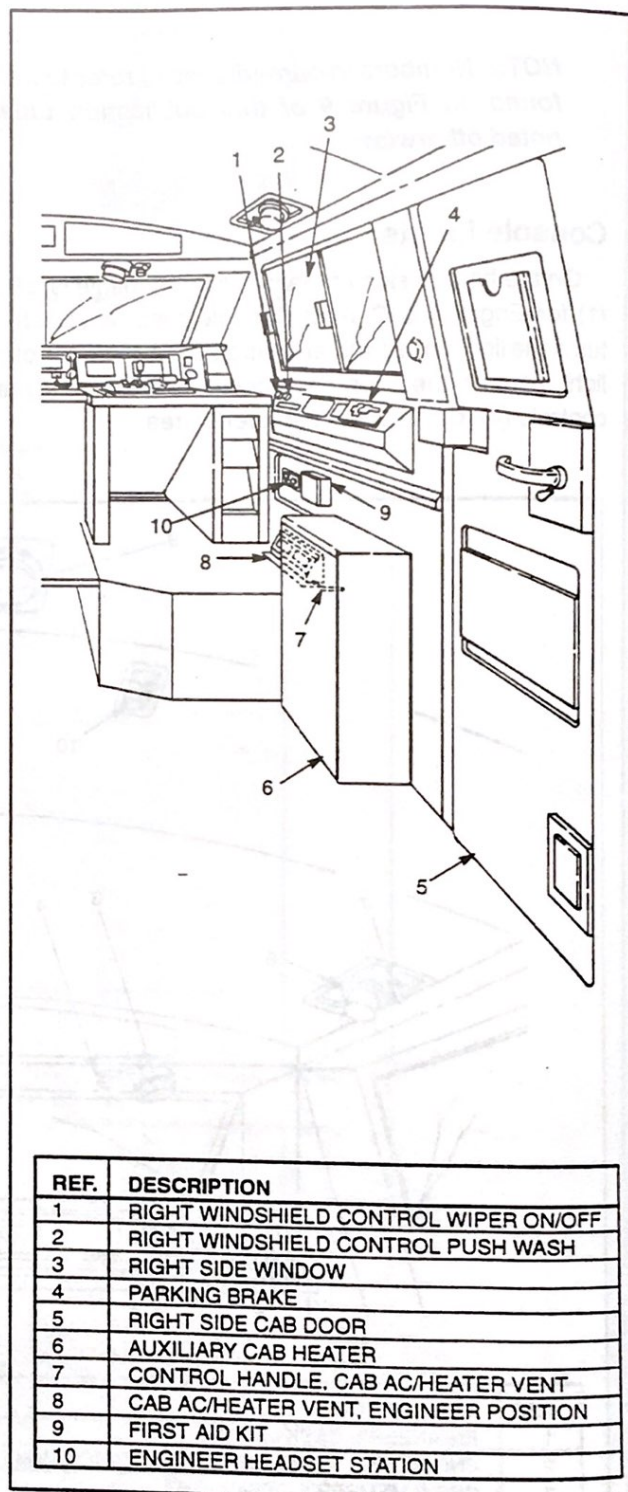


FIG. 10. OPERATING COMPARTMENT EQUIPMENT, RIGHT SIDE. E-42712.



## DEVICES ON CAB LEFT SIDE

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 11 of this publication unless noted otherwise.

### Windshield Wiper Operating Controls

The controls are for the left windshield. Push the WASH button (2) and turn the WIPER ON/OFF button (1) to control the functions.

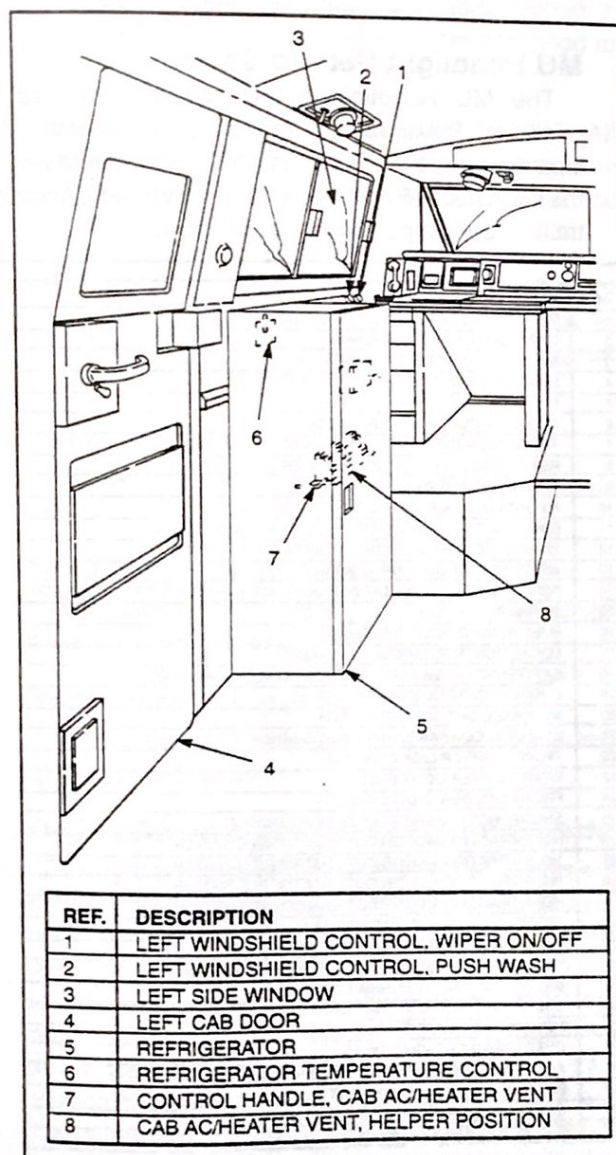


FIG. 11. OPERATING COMPARTMENT EQUIPMENT, LEFT SIDE. E-42713.

### Compartment Vents

The air conditioner/heater vent (8) is supplied at both the Engineer's and Crew Member's positions (a vent is also located above the EC Panel). A damper control handle (7) is included to enable flow control from the vent.

### Refrigerator

A refrigerator (5) is supplied behind the Crew Member's seat. The temperature control (6) is located on the back. The refrigerator is plugged into a GFI (Ground Fault Interrupt) receptacle and is powered from the HEP system. To reset this receptacle, simply press the reset pushbutton.

## DEVICES ON ENGINE CONTROL PANEL

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 12 of this publication unless noted otherwise.

The Engine Control (EC) panel is located on the rear wall of the operator's compartment. Mounted on this panel are various switches, circuit breakers and operating devices used during locomotive operation.

### Top Row of Circuit Breakers

The top row of circuit breakers (1-8) on the EC panel are used for equipment that can be turned OFF when the unit is operating as a Trail or Push unit depending on territory to be operated in.

The 74 VDC Circuit Breaker (5) provides overcurrent protection for the Radio and Intercom from the locomotive battery. The 12 VDC Circuit Breaker (6) provides overcurrent protection from the 12 V Battery. Overcurrent protection from the Battery Charger to the 12 V Battery is provided by the Radio Battery Charger Circuit Breaker (11).

### Second Row of Circuit Breakers

The second row of circuit breakers (10-18) on the EC panel are used for equipment, ALL OF WHICH MUST BE LEFT ON whenever the unit is operating as a Lead, Trail, or Push unit.

### Engine Stop Pushbutton

To shut down this engine only, press the Engine Stop pushbutton (9).



## Engine Control Switch

The Engine Control (EC) switch (19) has four positions:

1. **START** – The Engine Start switch, see Engine Start Station, is effective only when the EC switch is in START. When the engine is running and the EC switch is in START position, engine speed is held at IDLE and power cannot be applied to the locomotive. The power plant is said to be “off the line.” The alarm bell will not ring if the engine shuts down.
2. **ISOLATE** – When the engine is running and the EC switch is in the ISOLATE position, the engine speed is held at IDLE and power cannot be applied to the locomotive. HEP can be generated in the NORMAL mode. The message “ISOLATED” will appear in the Summary Message Area on the

IFD Function Screen. The alarm bell will sound if a fault occurs that will shut down the engine.

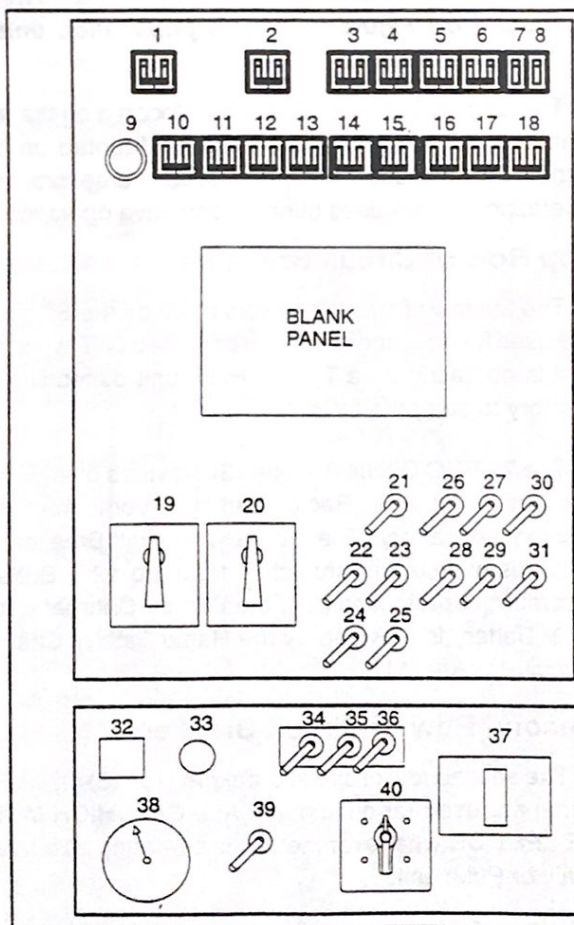
3. **RUN** – When the engine is idling and the locomotive is to be operated, the Engine Control (EC) switch must be moved to the RUN position.

**NOTE:** If the EC switch is left in the RUN or ISOLATE position when the diesel engine is shut down, the alarm bell will sound.

4. **JOG** – When the engine is shutdown and the locomotive is to be moved using battery power, the EC switch is moved to the JOG position.

## MU Headlight Set-Up Switch

The MU Headlight Set-Up switch (20) has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the short hood (F end) of the locomotive unit is leading or trailing. Switch positions are as follows:



| REF. | DESCRIPTION  |
|------|--|
| 1    | WINDOW HEATER CIRCUIT BREAKER                                |
| 2    | CAB SIGNAL CIRCUIT BREAKER                                   |
| 3    | SATELLITE SYSTEM CIRCUIT BREAKER                             |
| 4    | ROAD CROSSING LIGHTS CIRCUIT BREAKER                         |
| 5    | RADIO CIRCUIT BREAKER (74 VDC)                               |
| 6    | RADIO CIRCUIT BREAKER (12 VDC)                               |
| 7    | FRONT HEADLIGHT CIRCUIT BREAKER                              |
| 8    | REAR HEADLIGHT CIRCUIT BREAKER                               |
| 9    | ENGINE STOP PUSHBUTTON                                       |
| 10   | AIR BRAKE COMPUTER CIRCUIT BREAKER                           |
| 11   | RADIO BATTERY CHARGER CIRCUIT BREAKER (120 VAC)              |
| 12   | 120 VAC RECEPTACLE CIRCUIT BREAKER                           |
| 13   | AIR DRYER CIRCUIT BREAKER                                    |
| 14   | RUNNING LIGHTS CIRCUIT BREAKER (ALL LIGHTS EXCEPT HD/LIGHTS) |
| 15   | MARKER LIGHTS  |
| 16   | FUEL PUMP CIRCUIT BREAKER                                    |
| 17   | LOCAL CONTROL CIRCUIT BREAKER                                |
| 18   | BATTERY CHARGE AND COMPUTER CIRCUIT BREAKER                  |
| 19   | ENGINE CONTROL SWITCH  |
| 20   | MU HEADLIGHT SET-UP SWITCH                                   |
| 21   | CONTROL COMPARTMENT LIGHT SWITCH                             |
| 22   | FRONT MARKER LIGHT SWITCH                                    |
| 23   | REAR MARKER LIGHT SWITCH                                     |
| 24   | FRONT NUMBER LIGHTS SWITCH                                   |
| 25   | ENGINE ROOM MAINTENANCE LIGHT SWITCH                         |
| 26   | NO. 1 TRACTION MOTOR CUT-OUT TOGGLE SWITCH                   |
| 27   | NO. 2 TRACTION MOTOR CUT-OUT TOGGLE SWITCH                   |
| 28   | NO. 3 TRACTION MOTOR CUT-OUT TOGGLE SWITCH                   |
| 29   | NO. 4 TRACTION MOTOR CUT-OUT TOGGLE SWITCH                   |
| 30   | SPEED SENSOR CUT-OUT SWITCH                                  |
| 31   | LOCKED AXLE ALARM CUT-OUT SWITCH                             |
| 32   | NO BATTERY CHARGE INDICATOR LIGHT (NBCL NO CHG)              |
| 33   | BATTERY CONNECT PUSHBUTTON                                   |
| 34   | CAB SIGNAL CUT-OUT SWITCH                                    |
| 35   | ALERTER CUT-OUT SWITCH                                       |
| 36   | OVERSPEED CUT-OUT SWITCH                                     |
| 37   | AUXILIARY CAB HEATER CIRCUIT BREAKER                         |
| 38   | BATTERY CHARGING AMMETER                                     |
| 39   | ENGINE WALKWAY LIGHTS SWITCH (WWLS)                          |
| 40   | CAB SIGNAL TRANSFER SWITCH                                   |

FIG. 12. ENGINE CONTROL PANEL. E-42569.



1. SINGLE OR MIDDLE UNIT – Place switch in this position on any locomotive unit operated singly or on all units, except the Leading or Trailing unit, when the locomotive consist is made up of more than one unit.
2. FRONT END (SHORT-HOOD) LEAD – LEADING UNIT – Place switch in this position when the Leading unit is operated with the short hood forward.
3. REAR END (LONG-HOOD) LEAD – LEADING UNIT – Place switch in this position when the Leading unit is operated with the long hood forward.
4. FRONT END (SHORT-HOOD) TRAIL – TRAILING UNIT – Place switch in this position when the final Trailing unit is connected so its short hood trails.
5. REAR END (LONG-HOOD) TRAIL – TRAILING UNIT – Place switch in this position when the final Trailing locomotive is connected so its long hood trails.

### Control Compartment Light Switch

This switch (21) turns on lights in Control Areas 1, 2, 3, 4 and 5.

### Marker Light Switches

These switches (22 and 23) operate the marker lights at the front and rear of the locomotive.

### Front Number Light Switch

This switch (24) operates combined front number lights/nose cab lights.

### Engine Room Maintenance Light Switch

This light switch (25) controls the 120 VAC lights in the engine compartment for maintenance personnel. Switch has three positions: ON-HEP, ON-SHOP POWER and OFF. The ON-HEP position is to be used when Head End Power is operating (30 minute automatic time-out feature is also supplied). The 120 VAC RECEPTACLE circuit breaker (12) must be closed for this switch position to operate. The ON-SHOP position is to be used when power is being supplied by shop power (120 VAC). A 120 VAC power cord must be attached to the Engine Room Light Receptacle or outside receptacle, located in the windshield wash water compartment.

### Traction Motor Cut-Out Switches – Pull to Throw

The Motor Cut-Out switches (26–29) can be used to cut-out one or more traction motors. At the same time, power output of the locomotive may be reduced. See the TROUBLESHOOTING section of this publication.

**CAUTION:** It is recommended that these switches be operated only with the Engine Control switch in START or ISOLATE position so the unit is isolated and the Combined Power Handle in IDLE. Dynamic Brake operation will be affected.

Under emergency conditions, the locomotive may be operated for a short period of time with one or more motors cut-out. Refer to Railroad Rules for specific details of operation.

**NOTE:** A message will appear in the Summary Message Area on the IFD Function Screen when one of these switches is opened.

### Speed Sensor Cut-Out Switch

This switch (30) cuts out the Speed Sensor signal on all traction motors that are cut-out. This switch is only to be used to cut out faulty sensors; however, ensure that the sensor is at fault and not that it is indicating a locked axle or excessive wheel slip, etc. The sensor will only be cut out (even if switch has been thrown) if the motor cut-out switch has been thrown. This is a safety feature to ensure that wheel slip protection is not lost.

**NOTE:** A minimum of two motor speed sensors must be operating for the unit to load. Also, a message will appear in the Summary Message Area on the IFD Display Screen when this switch is opened.

### Locked Axle Cut-Out Switch

This switch (31) cuts out the Locked Axle Alarm. Before silencing the alarm using this switch, ensure the wheels are rolling. Follow Railroad Regulations governing use of this switch.

**NOTE:** As long as locomotive control computer is functioning and locked axle alarm cut-out switch is in normal (cut-in) position, locked axle protection is available in trailing units.



## NBCL NO CHG Indicating Light

The NO BATTERY CHARGE light (32) will illuminate when a problem is detected in the battery charge circuit. Check the Summary Message Area on the IFD for fault indication and refer to **TROUBLESHOOTING** section of this manual.

## Battery Connect Pushbutton

This pushbutton (33) enables the Battery Saver Circuit. The Battery Saver looks for battery charge from both chargers. If no charge to batteries from either charger is indicated for a period of 15 minutes, this circuit will order a **complete** (except for critical loads from Cab Signal, Marker Lights, Radio, Qualcomm Satellite System and Fuel Pump) **load disconnect** from the batteries.

**NOTE:** This pushbutton must be pressed at start-up or the locomotive will not crank.

## Safety Systems Cut-Out Switches

These switches (34, 35 and 36) are used to CUT-OUT or CUT-IN the Cab Signal and IITS, Alerter and Overspeed safety systems. Follow *Railroad Regulations governing use of these switches*. Refer to **SAFETY DEVICES** section for more information.

**NOTE:** In the cut-out position, the respective system cannot induce a penalty brake application

## Auxiliary Cab Heater Circuit Breaker

This circuit breaker (37) will cut out the heater located behind the engineer.

## Battery Charge Ammeter

This ammeter (38) shows current flowing into the batteries during charge or out during discharge.

## Engine Walkway Lights Switch

This switch (39) turns the engine walkway lights ON/OFF.

## Cab Signal Transfer Switch

This switch (40) allows the operator to select either the Cab Signal System or the Intermittent Inductive Train Stop System.

## CONTROL AREA 1

**NOTE:** Numbers in parentheses ( ) refer to Items found on Figure 13 of this publication unless noted otherwise.

The control locker in the operator compartment is called Control Area 1.

## Battery Switch

The Battery Switch (1) is used to connect and disconnect locomotive battery power from most control circuits.

## Intermittent Inductive Train Stop

The Intermittent Inductive Train Stop (2) is the main controller for the Automatic Train Stop. If the Intermittent Inductive Receiver picks up an inductive track signal and the Engineer does not depress the Acknowledge Button within a predetermined time period, IITS will initiate a Penalty Brake Application. The IITS reset button is located on the right side of the device.

## Auxiliary Alternator Field Cut-Out Switch (BFCO)

Auxiliary Alternator Field Cut-Out Switch (3) enables/disables the Auxiliary Alternator Field Contactor.

## Fan Reverse Switch

Fan Reverse Switch (4) is a momentary contact switch, which applies a fan reverse request to the CAB Controller. This feature is used to blow debris off of the radiator fan inlet screens. The radiator fan is allowed to run backwards only when the Master Controller Reverse Handle is centered.

## Integrated Function Computer

The Integrated Function Computer (5) is the communications center for all on-board locomotive control functions. The basic IFC function is to communicate data among the various on-board locomotive control functions.

## Event Recorder (CRD)

The Event Record (6) provides a means for downloading the event recorder memory for train/locomotive operation analysis. Download can be accomplished by either memory card or cable transfer.



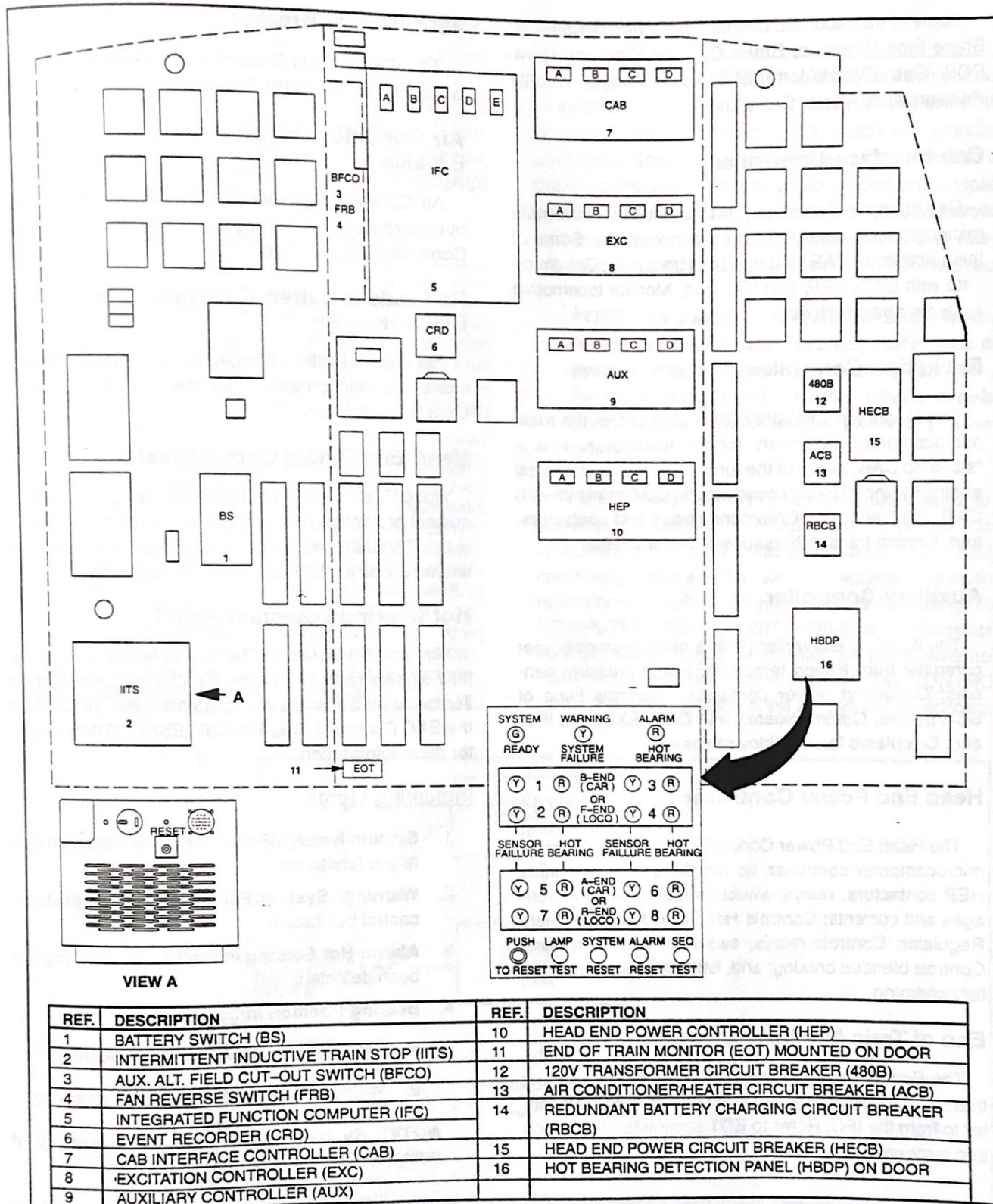


FIG. 13. CONTROL AREA 1 - CONTROL LOCKER AT THE REAR END OF THE OPERATING COMPARTMENT. E-42723.



Some of the recorded events are: Speed; Amperage; Brake Pipe Pressure; Brake Cylinder Pressure; Horn; PCS; Cab Signal/Alerter/IITS Acknowledge; Throttle Position; and, Alerter Cut-Out.

### Cab Interface Controller

Cab Interface Controller (7) is the "master" of the main microcomputer controllers for the locomotive. Some of the functions of CAB include: Read trainlines; Communicate with EXC, HEP, and IFC; and, Monitor locomotive systems and check data.

### Excitation Controller

The Excitation Controller (8) is also one of the main microcomputer controllers for the locomotive. It is a "slave" to CAB. Some of the functions of EXC are: Read analog systems; Read speed inputs; Communicate with CAB, HEP, and IFC; Command relays and contactors; and, Control traction horsepower and adhesion.

### Auxiliary Controller

The Auxiliary Controller (9) is a main microcomputer controller that: Reads temperature and pressure sensors; Command power contactors; Controls firing of SCR panels; Communicates with CAB, EXC, and IFC; and, Calculates fan and blower speeds.

### Head End Power Controller

The Head End Power Controller (10) is another main microcomputer controller. Its functions include: Reads HEP contactors, relays, switches feedbacks and voltages and currents; Controls Head End Alternator Field Regulator; Controls relays, switches, and contactors; Controls blended braking; and, Controls, redundant battery charging.

### End of Train Monitor

The End of Train Monitor (11) is a radio transceiver that routes status signals from the End of Train Transmitter to/from the IFC. Refer to EOT section for installation and removal procedures.

### 480B Circuit Breaker

The 480B Circuit Breaker (12) provides overcurrent protection for the 120V Transformer.

### Air Conditioner/Heater Circuit Breaker

Air Conditioner/Heater Circuit Breaker (13) provides overcurrent protection for the 480 VAC three-phase Air Conditioner/Heater Unit.

### Redundant Battery Charging Circuit Breaker

Redundant Battery Charging Circuit Breaker (14) provides overload protection for the Redundant Battery Charging Regulator.

### Head End Power Circuit Breaker

Head End Power Circuit Breaker (15) provides overcurrent protection for the Traction Alternator when HEP is in STANDBY mode and for the Head End Alternator when HEP is in NORMAL mode of operation.

### Hot Bearing Detection Panel

Hot Bearing Detection Panel (16) receives temperature signals from the Traction Motor Support Bearing Temperature Sensors and provides a status indication to the EXC Controller. See **TROUBLESHOOTING** section for more information.

### Indicating Lights

1. **System Ready** (Green) indicates detection system is functional.
2. **Warning: System Failure** (Yellow) indicates a control box failure.
3. **Alarm: Hot Bearing** indicates a hot bearing has been detected.
4. **Bearing Position Indicators**
  - a. Red indicates location of a hot bearing.
  - b. Yellow indicates location of a failed sensor.

**NOTE: System alarms are indicated by a summary message on the IFD.**



## AIR BRAKE EQUIPMENT

### INTRODUCTION

This section of the operating manual identifies and describes the general air brake equipment needed by the operator to control the locomotive. Actual operating procedures are located in **OPERATING PROCEDURES** sections of this publication.

### ELECTRONIC AIR BRAKE SYSTEM

**WARNING: STOPPING HAZARD.** Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 50 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

**WARNING: STOPPING HAZARD.** If 24 Volt power loss and Locomotive battery power loss to the NYAB/KNORR System occurs or system experiences an internal fatal failure, on LEAD UNIT, while train is in motion, a SERVICE Brake application is made (BP goes to zero and BC goes to 90 psig). Operator may NOT bail off BC pressure. Operator may still initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Control Console Left or moving the Automatic Brake Handle to EMERGENCY position.

As a continuation of the Integrated Function concept to localize most of the control operation in front of the operator and to eliminate (as much as possible) pneumatic devices in the cab area, the electronic air brake control system has been developed and supplied on this unit. The concept is a microcomputer controlled system replacing pneumatic system valves and relays with electronic controls also located in the air brake rack.

**NOTE:** The supplied electronic air brake feature is an Electro-pneumatic system; that means the system needs locomotive battery power to function. Also, verify that the circuit breaker (Item 10, Fig. 12) on the EC panel is properly positioned.

The elimination of much of the air brake control and pneumatic devices (through the use of the NYAB/KNORR CCB microprocessor air brake controller) reduces the air connections increasing reliability while also simplifying unit troubleshooting. The COMPUTER RELAY UNIT (CRU) and associated control devices (e.g., Transducers, Pressure Switches, Filter, etc.) mounted on the PNEUMATIC CONTROL UNIT (PCU) are located in the air brake compartment.

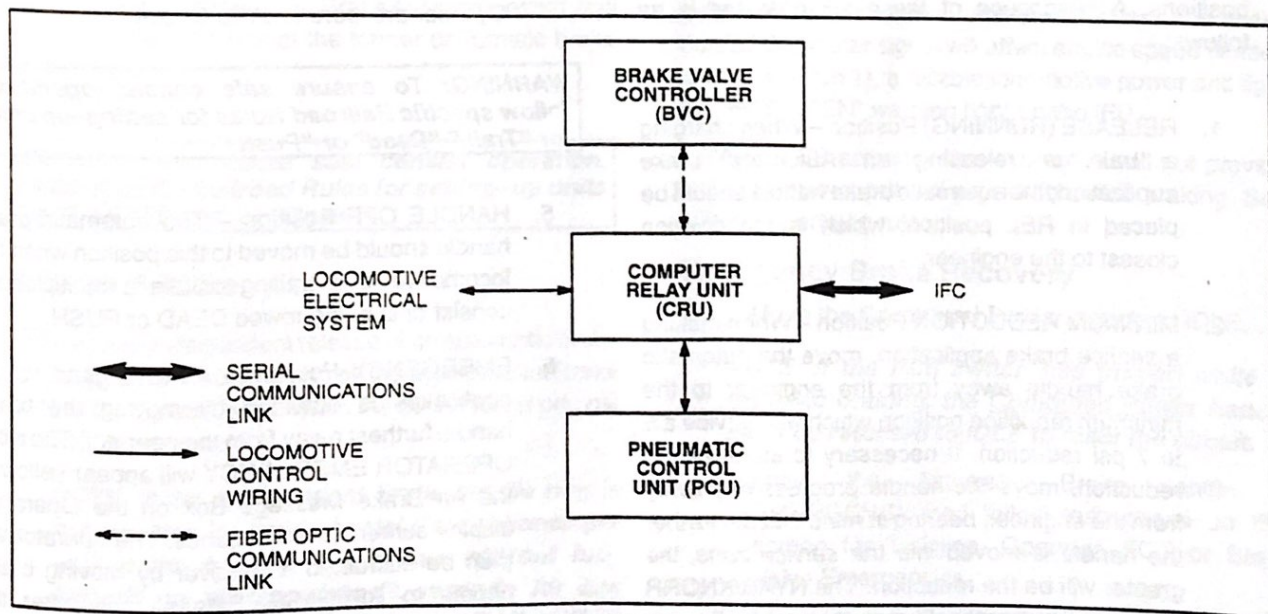


FIG. 14. ELECTRONIC AIR BRAKE SYSTEM OVERVIEW. E-41724A.



The NYAB/KNORR CCB Microprocessor Air Brake Control System (similar in operation to the Schedule 26-L equipment), arranged for single-end, multiple-unit operation, is used on this locomotive. The principal parts are as follows:

### Automatic Brake Handle

This unit is also equipped with blended brakes. Blended braking utilizes dynamic brakes as well as standard air brakes and is controlled by using the Automatic Brake Handle (Fig. 15). The system is designed to supply as much dynamic braking as possible with the remainder of needed braking coming from the standard air brakes per handle position.

**NOTE: Dynamic Braking is not available below five MPH; therefore, 100% of needed braking will come from the friction braking system as locomotive speed drops below five MPH.**

The Automatic Brake Handle operates through six detented control positions: RELEASE (REL), MINIMUM REDUCTION (MIN), SUPPRESSION (SUP), FULL SERVICE (FS), HANDLE OFF (HO), and EMERGENCY (EMER). The *service zone* is between minimum reduction and full service positions (MIN and FS). An indicating plate is provided indicating the six operating positions. A description of these six positions is as follows:

1. **RELEASE (RUNNING) Position** – When charging a train or releasing an Automatic brake application, the automatic brake handle should be placed in REL position, which is the position closest to the engineer.
2. **MINIMUM REDUCTION Position** – When making a service brake application, move the automatic brake handle away from the engineer to the minimum reduction position which will provide a 5 to 7 psi reduction. If necessary to increase the reduction, move the handle progressively away from the engineer, bearing in mind that the further the handle is moved into the *service zone*, the greater will be the reduction. The NYAB/KNORR system will automatically maintain any brake pipe leakage.

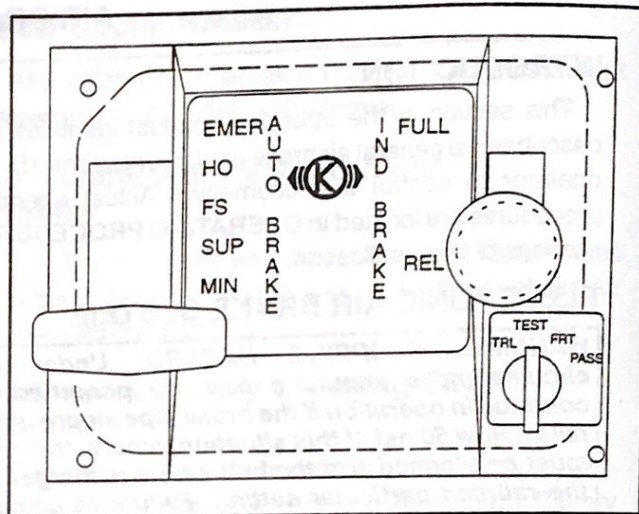


FIG. 15. NYAB/KNORR ELECTRONIC AIR BRAKE CONTROLLER (TYPICAL). E-42757.

3. **SUPPRESSION Position** – This position provides a 17 psi reduction. In addition, this position forestalls an Overspeed, Alarmer, and Cab Signal/IITS Overspeed Penalty.
4. **FULL SERVICE Position** – A Full Service brake application is obtained by moving the brake handle to this position which will reduce the Brake Pipe by 25 to 30 psi and increase the Brake Cylinder pressure to 57 to 64 psig.

**WARNING: To ensure safe consist operation, follow specific Railroad Rules for setting-up units for "Trail," "Dead" or "Push."**

5. **HANDLE OFF Position** – The automatic brake handle should be moved to this position when the locomotive is a trailing unit in a multiple-unit consist or is being towed DEAD or PUSH.
6. **EMERGENCY Position** – An Emergency brake application is obtained by moving the brake handle furthest away from the operator. The word OPERATOR EMERGENCY will appear yellow in the Air Brake Message Box on the Operation display screen for 60 seconds. The operator will then be instructed to recover by moving brake handle to RELEASE. Release only after the locomotive comes to a complete stop and the reason for the emergency has been cleared.



**NOTE:** If operating as a lead unit, the control imposes a one minute time delay before it is possible to recharge the brake pipe after an emergency application.

**NOTE:** No fault message will be stored for Power Braking limitations.

**NOTE:** Power braking limitations apply to P42-DC locomotives whether in lead, trail, or push mode. If trailing unit is load-limited from excessive power braking, the lead unit has no alarm nor indication. Thus, if this occurs, trail unit could be in idle without operator knowing it.

### Independent Brake Handle

**NOTE:** If independent brake is applied, dynamic braking effort is decreased depending on locomotive speed, see OPERATING PROCEDURES, Applying Dynamic Brake.

When applying the locomotive independent brake using the independent brake handle (Fig. 15), move the independent handle away from the engineer (Full Independent application – FULL position), and when releasing, move the handle toward the engineer (REL position). The movement of this handle provides input signals to the Electronic Air Brake Microprocessor and duplicates the functions of the former pneumatic brake valve handle.

**WARNING:** To ensure safe consist operation, follow specific Railroad Rules for setting-up units for "Trail," "Dead" or "Push."

### Bail-Off Feature

To make an independent release of an automatic brake application, pull up on the ring on the Independent Brake handle. Spring action will return the button to the original position when released.

**NOTE:** If the Independent Brake handle ring is not actuated for approximately four seconds per unit in the consist, the brakes will not fully bail-off on all the units (8 seconds for any trailing units with malfunctioning EAB or EAB power loss).

### Brake Pipe Cut-Off Pilot Switch

This switch simulates the brake pipe cut-off pilot valve. This switch (Fig. 15) has four positions; TRL, TEST, FRT and PASS. A description of these four positions is as follows:

1. TRL Position – This position is used when the locomotive is operated as a Trail unit in a multiple-unit consist, Push or Dead-in-Train.
2. TEST Position – When making brake pipe leakage tests this position is used to nullify the pressure maintaining feature. To restore control of the automatic brake pressure maintaining feature, this switch must be returned to the FRT or PASS position.
3. FRT Position – This position is used when the locomotive is operated as a Lead unit and provides direct release of the brakes.
4. PASS Position – This position is used when the locomotive is operated as a Lead unit and provides for graduated release of the air brakes.

### Pneumatic Control Switch Operation

The Pneumatic Control Switch (PCS) Function is operated from the Electronic Air Brake system. During a safety control Penalty or Emergency brake application (power knockdown), this function activates. The Brake Control Computer signal will affect engine speed (limited to Idle or Notch 1), available locomotive power and light the "PCS OPEN" warning light on the IFD.

When PCS activates the locomotive will not provide motoring power, but will provide blended braking. See railroad operating rules.

### Emergency Brake Recovery

1. Move the **Combined Power** Handle to IDLE.

**NOTE:** If the PCS switch has tripped while in dynamic braking, the Combined Power Handle must be returned to IDLE to reset the circuit.

2. Move the Automatic Brake handle to EMERGENCY and follow instructions on IFD screen for Trainline, Operator, EOT or Brake Valve Emergencies.
3. Move the Automatic Brake Valve handle to RELEASE.



## Penalty Brake Recovery

There are three ways a Penalty Brake application may be initiated: From the Alerter; Because Of Overspeed; From the Cab Signal/Inductive Train Stop system. A Penalty Brake is annunciated on the IFD screens. An IITS is indicated on the Engineer's display panel as a red light. Reset these conditions as follows:

### Alerter Penalty

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Reset Alerter.
4. Allow time-out per operator message on the IFD Display.
5. Move the Automatic Brake handle to RELEASE and charge the brake system. Alerter must have been reset or the brake pipe (BP) will only charge to 50 psi and then reduce.

### Locomotive Overspeed Penalty

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Reduce locomotive speed to below limit.
4. Allow time-out per operator message on the IFD Display.
5. Move the Automatic Brake handle to RELEASE and charge the brake system.

### Cab Signal Penalty

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Acknowledge Cab Signal.
4. Reduce locomotive speed to limit imposed by Cab Signal.
5. When Cab Signal system resets, red overspeed light on cab signal display panel will turn off.
5. Allow time-out per operator message on the IFD Display.
6. Move the Automatic Brake handle to RELEASE and charge the brake system.

### IITS Penalty

1. Move Combined Power Handle to IDLE.
2. Move the Automatic Brake handle to the SUP (suppression) position.
3. Depress and hold the acknowledgement button (red) on the engineer's control console for approximately two (2) seconds.
4. Depress and hold the ATS reset button (small black button) for at least two seconds. (See Item 2 at View "A," Fig. 13.)
5. Allow time-out per operator message on the IFD Display.
6. After the red ATS light labeled "overspeed" on the cab signal control panel and the PCS light go out, move the Automatic Brake handle to the RELEASE position.

### Air Brake Setup

The Air Brake Setup (Fig. 16) function receives data from the NYAB/KNORR System. Operators use this screen to verify or regulate settings of the locomotive. Screen parameters may **not** be changed if the unit is moving (faster than 0.5 mph). If the current setup is not correct for the current consist and/or trip, proceed to the Operation Section that follows.

**NOTE: Every time power is shut-off to the NYAB/KNORR System, the Automatic Brake handle must be moved to SUPPRESSION for at least 40 seconds after power has been restored to reset the brake system.**

### Electronic Regulating Valve Pressure Adjustment

**NOTE: These Regulating Valve Adjustment keys are NOT available on the Crew Member's Display.**

Pressing key position F2, **Air Brake Setup**, on the Operator Function Screen (screen 300 000, see Fig. 62) will display screen 320 000. Follow Railroad procedures for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key positions F1 and F2 ("**Up**" and "**Down**" Arrows) will allow adjustment of the Regulating Valve pressure for the Equalizing Reservoir by 1 psi. The computer permitted range is 73 to 112 psig.



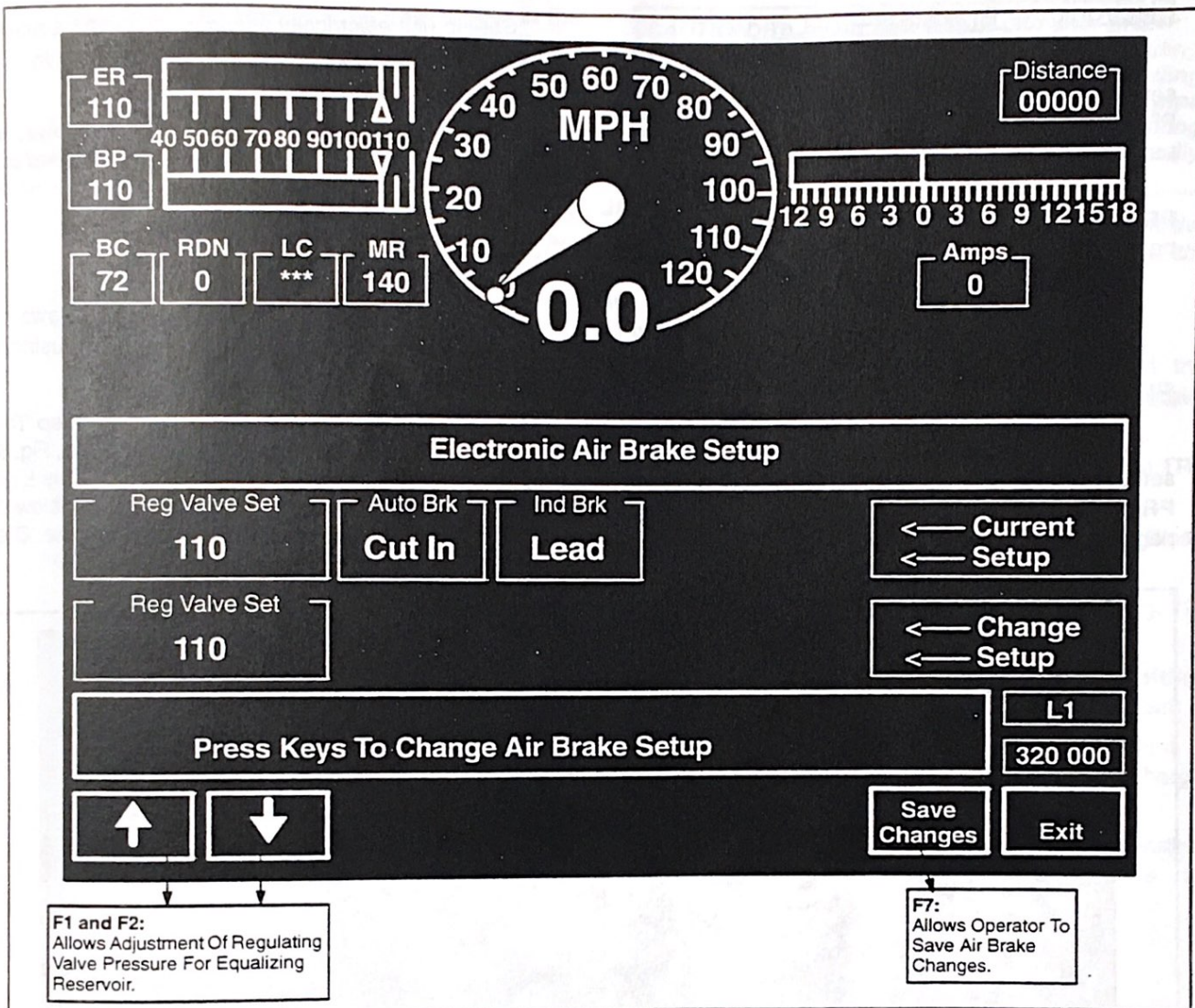


FIG. 16. ELECTRONIC AIR BRAKE SETUP SCREEN (320 000). E-42584.

**NOTE:** The message line will change from "Press Keys To Change Air Brake Setup" to "Note: This Setup Is Not Saved" (message block and text will also turn yellow) as soon as one of the setup keys has been pressed. Also, if the unit speed is 0.5 mph or less or if the computer senses inactivity for more than three minutes, screen 320 000 will be displayed again with the original setup parameters.

- Pressing either key (F1 or F2) will activate key position F7 (**Save Changes**). Pressing F7 the first time will change key color to yellow and banner message to yellow. Pressing F7 (**Save Changes**)

again saves the new setup and exits to screen 300 000.

**NOTE:** No changes made on screen 320 000 are acknowledged by the Brake Computer until they have been saved (twice) using the "Save Changes" key. Also, if either F1 or F2 is pressed again before the second "Save Changes", the computer will erase the first "Save Changes."

- Pressing key position F8 (**Exit**) will display "No Changes Saved" in yellow for three seconds and then the computer will return the operator to screen 300 000.



### Electronic Air Brake Set-up, Lead

To operate the locomotive as a Lead unit of a consist, set-up the air brakes according to **OPERATIONAL PROCEDURES, Air Equipment Set-Up** (Lead Unit) on page 96.

Set-up unit electrically according to **OPERATIONAL PROCEDURES, Electrical Set-Up** (Lead Unit) on page 97.

**NOTE: Ensure all other locomotives in the consist are set-up in Trail before attempting to set this locomotive to Lead.**

### Electronic Air Brake Set-up, Trail

To operate the locomotive as a Trail unit of a consist, set-up the air brakes according to **OPERATIONAL PROCEDURES, Air Equipment Set-Up** (Trail Unit) on page 97.

Set-up unit electrically according to **OPERATIONAL PROCEDURES, Electrical Set-Up** (Trail Unit) on page 97.

**NOTE: A loss of IFC power or EAB power will result in a Penalty Brake application in lead only. Refer to TROUBLESHOOTING section of this publication for reset procedures.**

### Air Brake Departure Test

The air brake departure test function allows the operator to perform a locomotive departure test using the IFD screen.

1. Pressing key position F4 (**Air Brake Dep Test**) from the Operator Test Screens (360 000, Fig. 65) will display screen 364 000 (Fig. 17). This key is only active if the unit speed is equal to or below 0.5 MPH. This key is not available on the Crew Display. Proceed with test as follows:

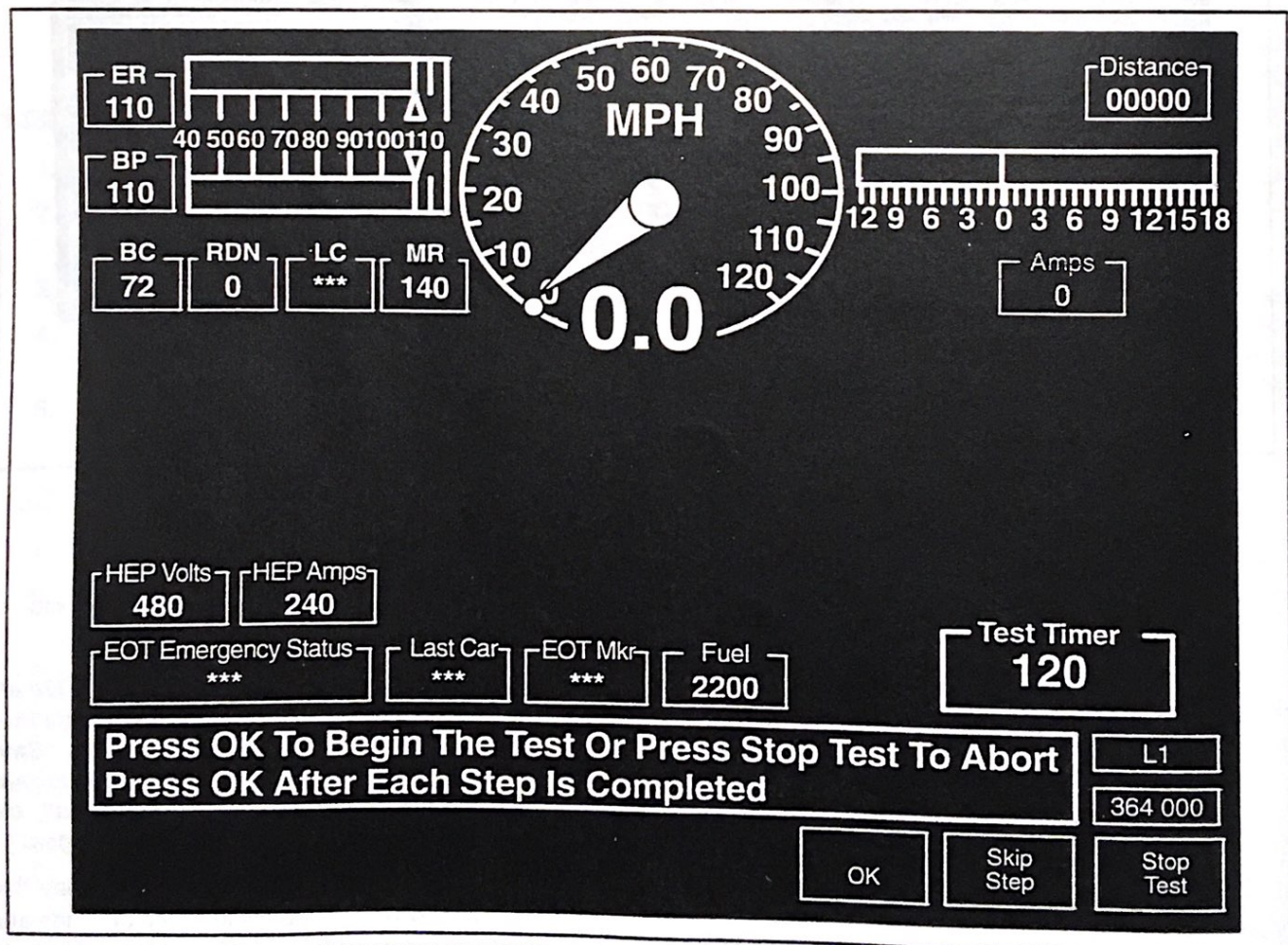


FIG. 17. LOCOMOTIVE DEPARTURE TEST SCREEN (364 000). E-42591.



- a. Follow the directions as they appear in the Summary message area. After completion of each step, press key F6, OK.

**NOTE:** If locomotive speed exceeds 0.5 MPH, the control system will stop the test and return the operator to screen 360 000. Also, normal operator instruction messages will appear with normal background color; however, other messages (e.g., Error and Test Skipped Messages) will appear with a yellow background.

- b. If the operator encounters a problem with a certain step, pressing key F7, **Skip Step**, will bypass this step and proceed to the next test step.

**NOTE:** Pressing F7 "Skip Test" key during any operator test will result in "Test Fail" message on IFD on completion of test.

- c. Operator may stop the test at any time by pressing key F8, **Stop Test**, and the computer will jump to the last test step.
- d. Upon completion of the test, results of the test will be displayed and the IFD display will return to screen 360 000.

**NOTE:** Be governed by Railroad Rules and Procedures for locomotive air brake tests.

**NOTE:** Test Timer is included for use during timed leakage tests. The counter will count down in seconds (otherwise it does not appear).

2. Pressing key position F8 (Exit) will return the display to screen 300 000.

## DEAD HEADING (DEAD-IN-TRAIN)

The dead engine fixture (Item 3, Fig. 27) provides Brake Pipe (BP) air to the Main Reservoir Pipe (MR) of a locomotive being hauled dead-in-train. This air supply allows the brakes of the dead locomotive to operate.

Since this flow is not required on an operating locomotive, a cut-out cock is provided in the line to allow the dead engine fixture to be cut-out. This cut-out cock should be kept closed except when a locomotive is being hauled dead with no Main Reservoir air available.

**CAUTION:** To avoid equipment damage, properly set-up this locomotive when hauling dead-in-train. Brake Pipe pressure on Controlling Unit must be set to 90 psig or greater. If brake pipe cannot be set to 90 psig or higher on controlling locomotive, the Parking Brake must be manually released. (See page 45.)

**NOTE:** Instructions for towing this locomotive dead-in-train are posted on both sides of the locomotive.

1. Ensure the parking brake is applied.
2. Place the Independent Brake handle in the RELEASE position and the Automatic Brake handle in the HANDLE OFF position.
3. Set the brake-pipe cut-off pilot switch to the TRL position.
4. Drain both main reservoirs to zero psig. Close drain valves after draining.
5. Open Air Brake circuit breaker (Item 10, Fig. 12) on the EC panel.
6. **Connect only the brake pipe hoses on either end of the locomotive and open angle cock.**
7. Cut-in the Dead Engine Cut-Out Cock (Item 1, Fig. 18) through hatch (Item 8, Fig. 3) and charge the brake-pipe.
8. **Release the Parking Brake.** In the Operating Compartment, turn the parking brake to RELEASED (Item 4, Fig. 10).
9. Conduct required air brake test.

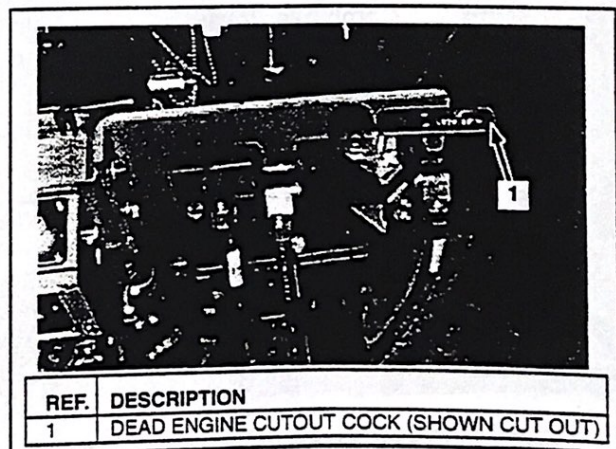


FIG. 18. DEAD ENGINE CUT-OUT COCK.  
E-42779.



## AIR COMPRESSOR

This locomotive uses an air compressor driven by an electric motor. Motor speed and compressor loading are controlled by the EXC Controller. The Compressor Governor Switch (CGS), located on the compressor control panel (Item 4, Fig. 20), monitors main reservoir pressure and provides a pressure signal to EXC. EXC, in turn, energizes the compressor drive contactor to start the air compressor drive motor. After two seconds, EXC de-energizes the Compressor Magnet Valve (CMV) to load the compressor (Item 3, Fig. 20). Speed of the air compressor drive motor is also monitored. If EXC has commanded the drive motor to start, but motor speed is not within limits, a **FAULT** will be logged, and the **SUMMARY** message "WARNING! Air Compressor Does Not Pump" will be displayed. (See **TROUBLESHOOTING** section.)

### Faster Air Pumping

To provide faster air pumping on locomotive, when reservoirs have been drained or after the locomotive has been coupled to a train, proceed as follows:

1. Leave the Generator Field circuit breaker in the OFF position.
2. Close the Control breaker on the control console right.
3. Insert the **Reverser** Handle (place in center OFF position).
4. Move the **Combined Power** Handle to Notch 1. The air compressor speed is twice engine speed when the engine speed is below 525 RPM.

### Checking Oil Level

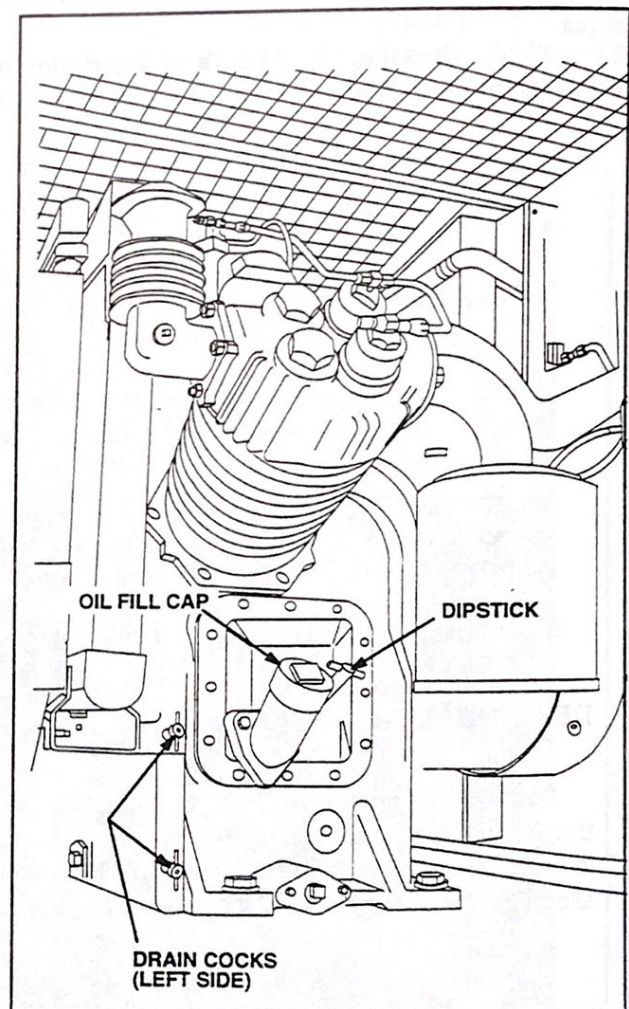
**WARNING: Rotating Equipment** – the air compressor motor could start at any time. Disable the compressor drive contactors by opening the Local Control Circuit Breaker (LCCB) before checking or changing the air compressor lubricating oil.

The compressor is equipped with an oil level dipstick, which is located on the left side of the locomotive (Fig. 19).

When using the dipstick to take an oil level reading, the dipstick should first be removed and wiped clean, then it is reinserted. Ensure the dipstick is fully seated, then remove it and take the reading. Add oil as indicated on the dipstick.

### Intercooler Drain Cocks

Open the intercooler drain cocks, two on left side and two on right side, (Fig.19) each time the oil level is checked. This allows accumulated moisture and small amounts of lubricant to be exhausted. Close the petcocks when moisture has been drained.



**FIG. 19. AIR COMPRESSOR LUBE-OIL DIPSTICK. CHECK OIL LEVEL FROM LEFT SIDE OF LOCOMOTIVE. E-38383B.**



## Manual Loading and Unloading

**NOTE:** For normal automatic operation of the air compressor, the compressor cut-out cock must be open, the Compressor Magnet Valve (CMV) must be unlatched, and the governor test fitting must be fitted. The compressor cut-out cock cuts out the air supply to CMV.

### Manual Loading

**WARNING:** Do not allow the locomotive to operate in this mode unattended. The Compressor Governor Switch is "locked out" of the compressor control circuit at this time. The safety valve will open when pressure reaches its operating pressure, but no other device will keep main reservoir pressure within safe limits.

**NOTE:** The Local Control Circuit Breaker (LCCB) must be closed before the Compressor Drive Motor (CDM) can operate.

The air compressor can be manually loaded by removing the governor test fitting (Item 2, Fig. 23) and

leaving the Compressor Magnet Valve (Item 3, Fig. 20) unlatched. When the governor test fitting is removed, the line to the Compressor Governor Switch (Item 4, Fig. 20) is exhausted. This sends a "load" signal to the EXC, which in turn causes the motor to start, and two (2) seconds later, the CMV to de-energize (exhausting air) to load the compressor.

### Manual Unloading

The air compressor can be manually unloaded by removing the governor test fitting and latching the Compressor Magnet Valve (Item 3, Fig. 20).

Return the compressor magnet valve to the unlatched position and fit the test fitting before returning the locomotive to service.

### Air Compressor Safety Valves

The air compressor has a safety valve located on the Intercooler and a safety valve located on the Aftercooler. They are set to open at 60 psig and at 180 psig respectively.

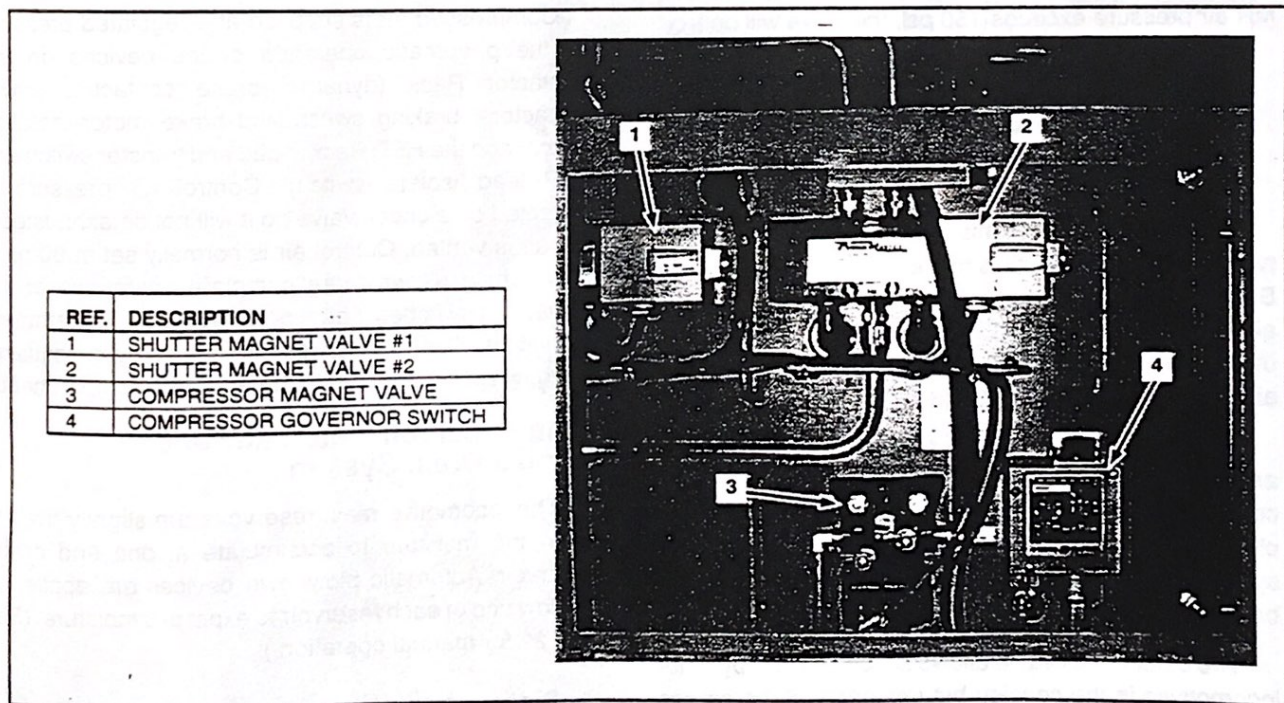


FIG. 20. AIR COMPRESSOR CONTROL PANEL. E-42778.



## AIR FLOW SYSTEM

**WARNING:** *Compressed air is extremely dangerous if not handled carefully. When working with compressed air equipment, DO NOT attempt to service, repair or break any connections without bleeding ALL air pressure from the device and ALL piping leading to it.*

Compressed air is supplied by the Air Compressor to the air brake equipment, as well as the auxiliary air devices and the compressor control governor. (See Fig. 21. for Air Flow Diagram.)

Compression heats the air and increases the amount of moisture per cubic foot of air. The compressor intercoolers serve to cool air between two compression stages; this increases compressor efficiency. The air is further cooled by an integral aftercooler as it leaves the compressor.

Compressed air then enters the first main reservoir, where more cooling and moisture condensation takes place. An air diffuser at the outlet of the reservoir prevents water in the reservoir from entering the discharge pipe.

A safety valve, located at the outlet of the first main reservoir, monitors Main Reservoir (MR) air pressure. If MR air pressure exceeds 150 psi, the valve will open.

**NOTE:** *Safety valve operation can be an indication of an incorrectly set Compressor Governor Pressure Switch (CGS), a faulty compressor unloader system or a faulty safety valve.*

Compressed air from the first main reservoir is routed two ways. The first route is to the Compressor Governor Switch (CGS), which provides a feedback signal of the air pressure to the EXC Controller. The EXC Controller utilizes the feedback signal to govern the operation of the air compressor, and hence, the output air pressure.

The second route is to an air dryer and check valve arrangement. In this arrangement, two check valves, connected to the MR equalizing pipe, are used. One check valve allows consist air to enter the locomotive air system, but the air must first pass through the air dryer before it becomes available for locomotive use.

The other check valve allows air to be drawn by other locomotives in the consist; but ensures that the air has passed through the dryer before being made available to other units.

Compressed air from the air dryer can now flow via platform piping to various components and devices as follows: 1) Through an auxiliary air filter to feed the auxiliary air devices; 2) To the MR equalizing pipe via the check valve (previously described) to other locomotives in the consist; and, 3) To the second main reservoir for use by air brake and control system devices.

The main reservoir supplies air to the auxiliary system. These devices include the Sanders, Windshield Wipers, Windshield Washer, Bell, and Horn.

Air enters the second main reservoir through a check valve; the valve prevents air from flowing backwards to the first MR. Therefore, the first main reservoir can lose air, while the second maintains pressure for air brakes.

The air continues to flow through the second MR and a vented cut-out cock, provided at the outlet of the reservoir. This cut-out cock allows the MR air supply pipe and filters to be vented without venting MR air pressure.

Main reservoir air is further cleaned by the air filter. The air, cooled and cleaned, is now available for air brake equipment and the Control Air System.

Compressed air is supplied at a regulated pressure for the pneumatic operation of the devices on the Contactor Rack (dynamic brake contactor, power contactors, braking switch and brake-motor-isolation switch) and the HEP Rack (head end transfer switch and HEP lead isolate switch). Control air pressure is protected by a check valve so it will not be exhausted if MR air is vented. Control air is normally set at 80 psig. This setting allows three complete operations of the contactors/switches as required by Government regulation. Control air pressure is set by a regulator valve, which is mounted in the air brake compartment.

### Main Reservoir Automatic and Manual Drain System

The locomotive main reservoirs are slightly tilted to allow the moisture to accumulate at one end of the reservoir. Automatic blowdown devices are applied at the low end of each reservoir to expel this moisture. (See Fig. 22 for manual operation.)

Similar manual devices are used to expel accumulated moisture from the main and auxiliary air filters.



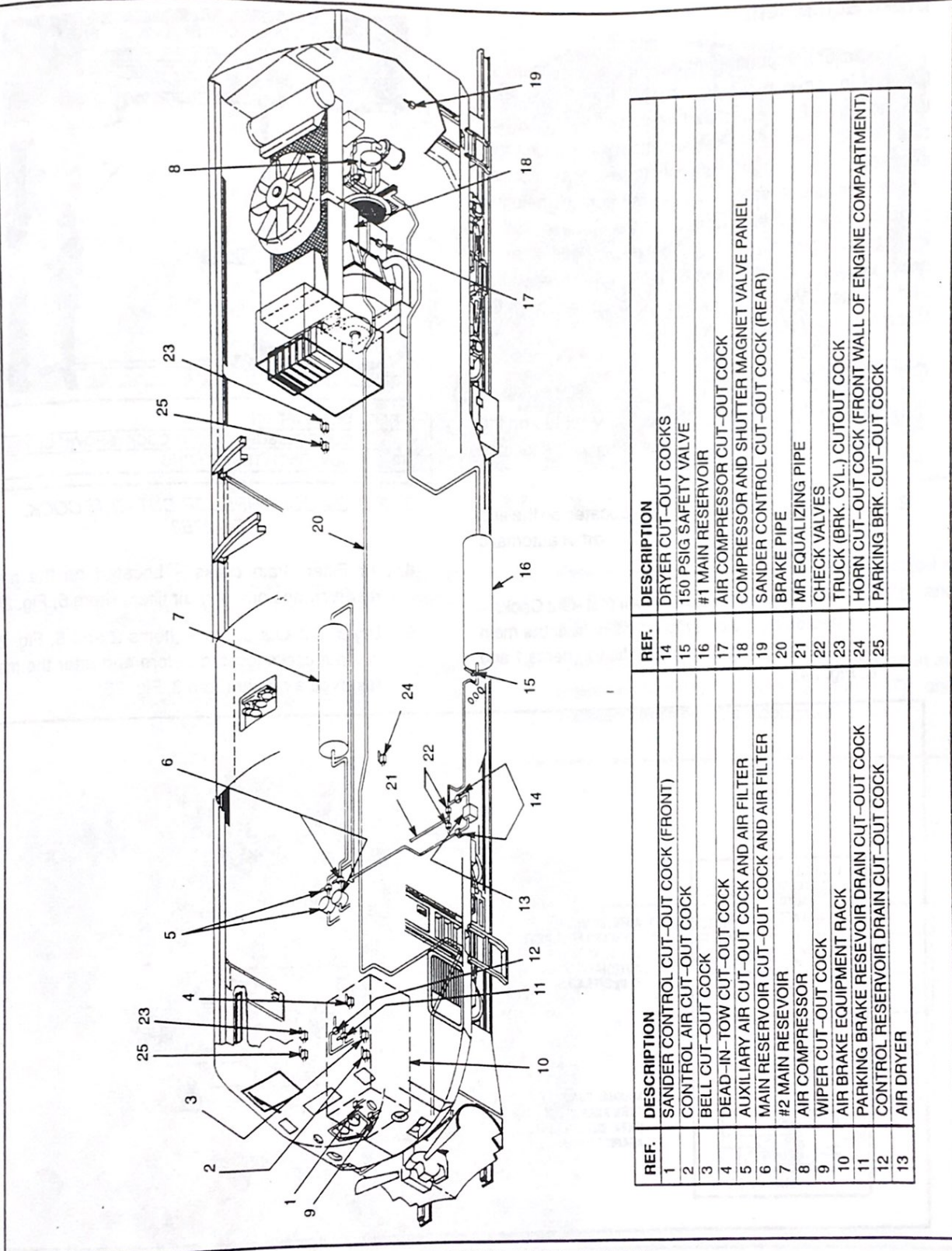


FIG. 21. AIR FLOW DIAGRAM. E-42716.



## Brake Equipment

The major components of the Air Brake System are located in several areas of the locomotive. The locomotive Air Brake Compartment, located on the right side of the locomotive, houses most of the air brake equipment. The right control (operator's) console houses the Brake Valve and the left control (helper's) console houses the Emergency Brake Valve Button. Piping and tubing connecting the various parts of the air brake system (and providing multiple-unit connections) and the two Vent Valves are located beneath the locomotive platform.

## Cut-Out Cocks

1. Air Compressor Cut-Out cock – Mounted on the compressor control panel (Item 1, Fig. 23) located in the radiator compartment.
2. Main Reservoir Drain Valves – Located on the end of each main reservoir (Fig. 22), part of automatic drain valves.
3. Main Reservoir and Auxiliary Air Cut-Out Cocks – Located on right side of locomotive near the main reservoir and auxiliary air final filters (Items 1 and 8, Fig. 24).

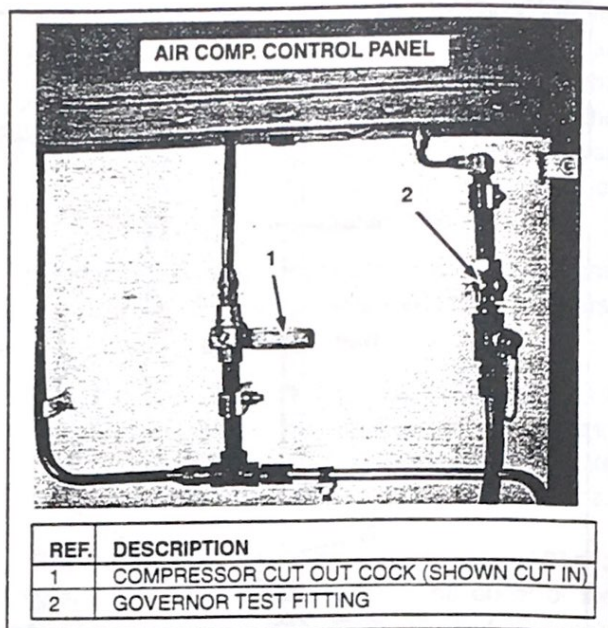


FIG. 23. COMPRESSOR CUT-OUT COCK.  
E-42782.

4. Air Filter Drain cocks – Located on the main reservoir and auxiliary air filters (Item 6, Fig. 24).
5. Dryer Cut-Out cocks – (Items 2 and 5, Fig. 25) cut-out cocks located before and after the main reservoir air dryer (Item 3, Fig. 25).

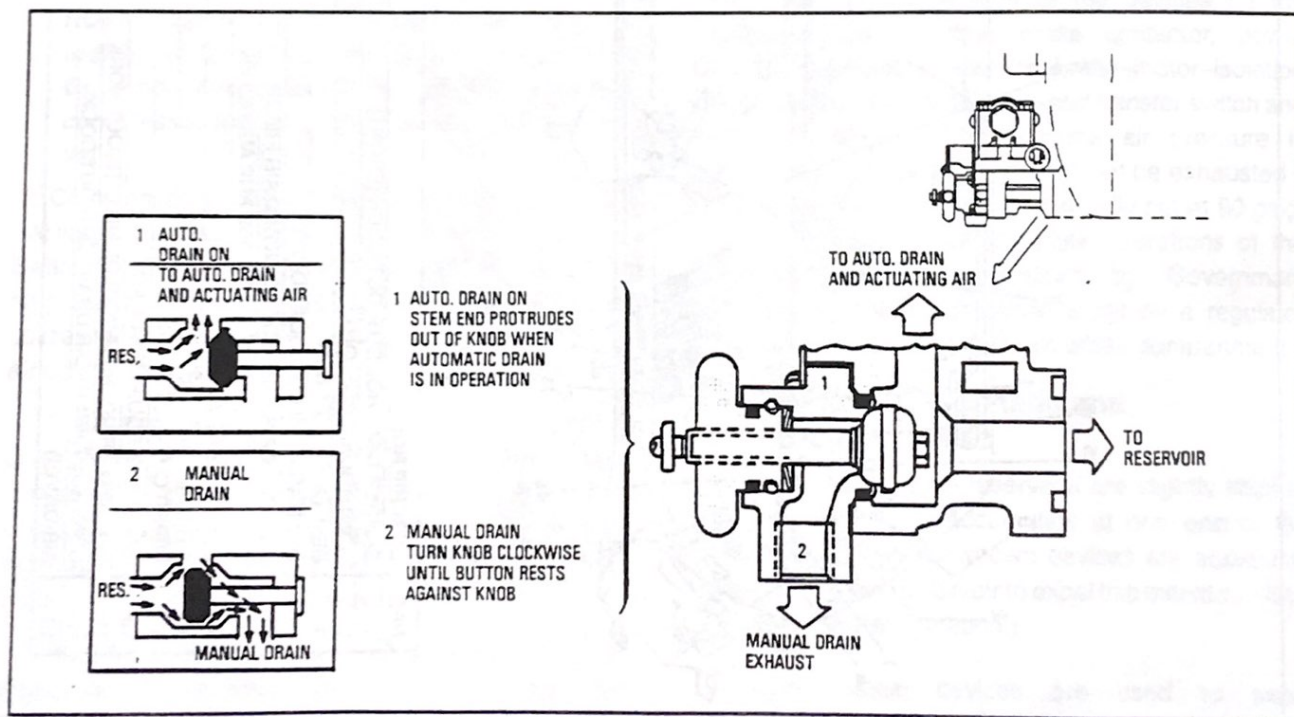


FIG. 22. OPERATION OF AUTOMATIC DRAIN VALVE. E-33702A.



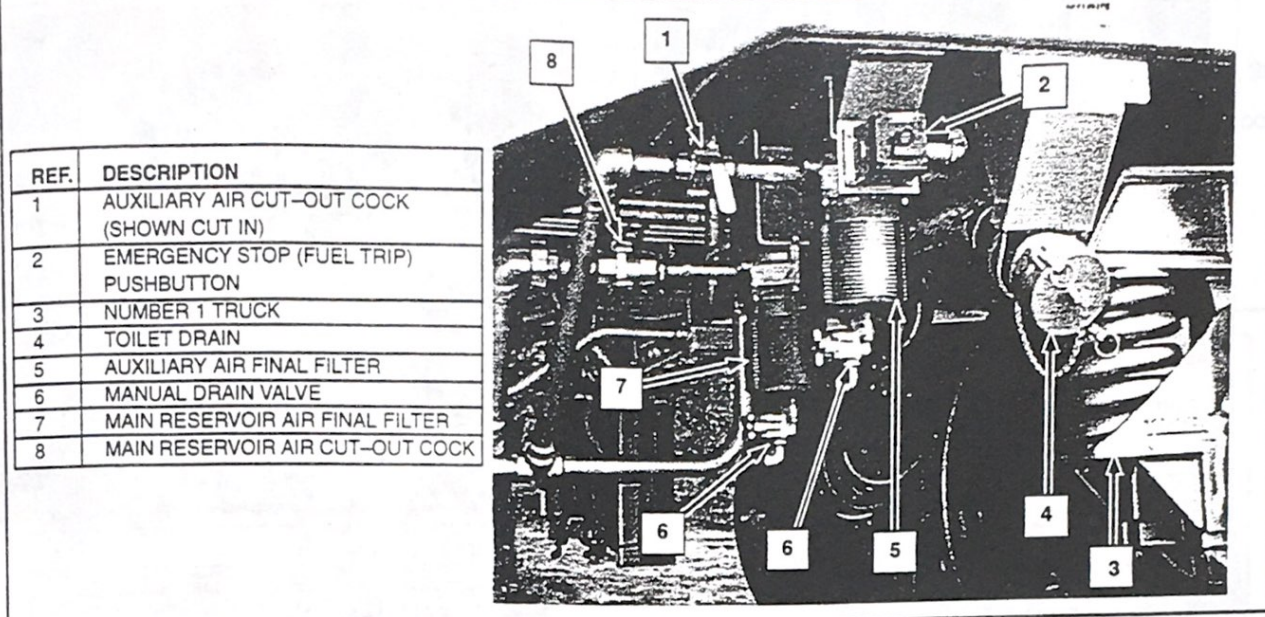


FIG. 24. MAIN AND AUXILIARY AIR CUT-OUT COCKS AND FILTERS. E-41055A.

6. Control Air Cut-Out cock – (Item 1, Fig. 26)  
Located in air brake compartment and accessed from operator's cab (Item 9, Fig. 3).

7. Bell Cut-Out cock – Located in air brake compartment (Item 2, Fig. 26) and accessed from operator's cab (Item 9, Fig. 3).

8. Parking Brake Reservoir Drain cock – Located in air brake compartment (Item 1, Fig. 27) and accessed from outside locomotive.

9. Control Air Reservoir Drain cock – Located in air brake compartment (Item 2, Fig. 27) and accessed from outside locomotive.

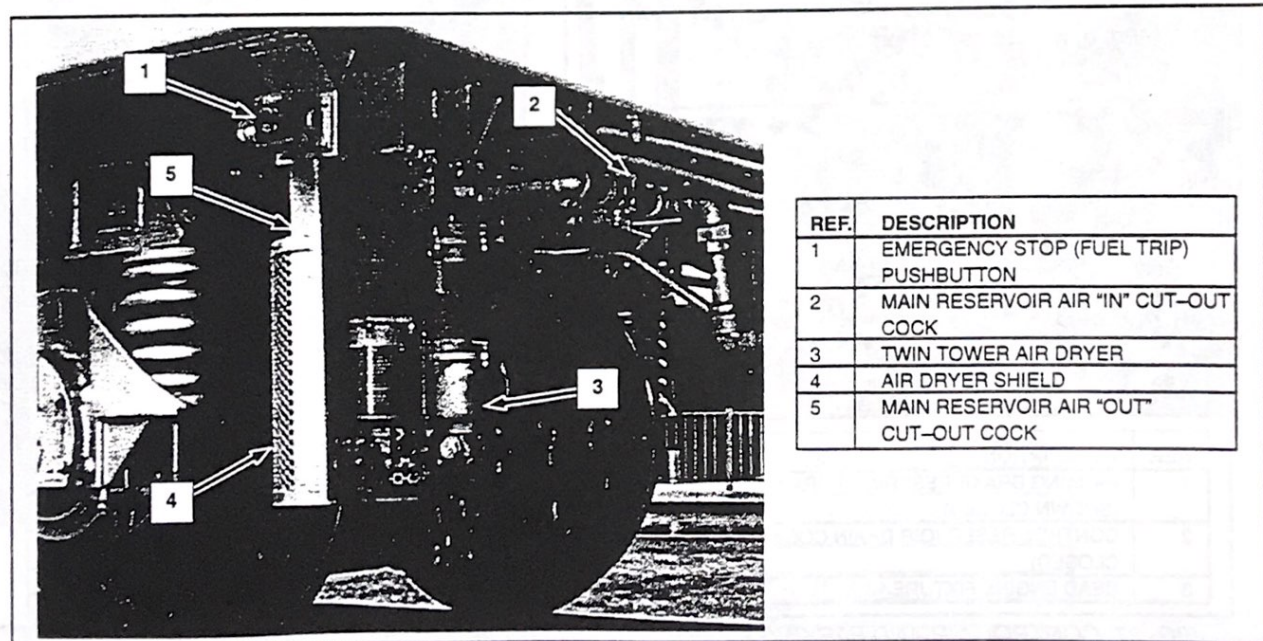


FIG. 25. LOCOMOTIVE TWIN-TOWER AIR DRYER SYSTEM. E-41056A.



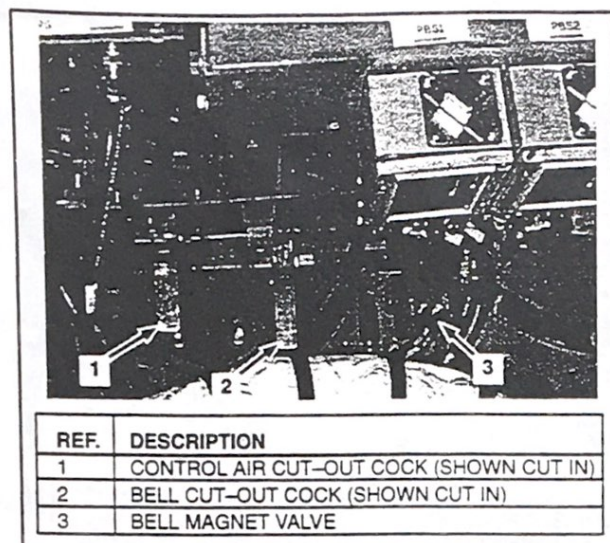


FIG. 26. CONTROL AIR AND BELL CUT-OUT COCKS. E-42742.

10. Dead Engine Cut -Out Cock - (Item 1, Fig. 18)  
Located in air brake compartment. Access to this cock is through the Operating Compartment floor (Item 8, Fig. 3). (See Label on CA1 Access Door.)

11. Sander Control Cut-Out cocks - The front sander cut-out cock (Item 1, Fig. 28) is located in the nose compartment. The cut-out cock (Item 1, Fig. 29) for the rear sander is located inside the radiator compartment below the sand box.

12. Wiper Cut-Out cock - The wiper cut-out cock (Item 2, Fig. 28) is located in the nose cab.

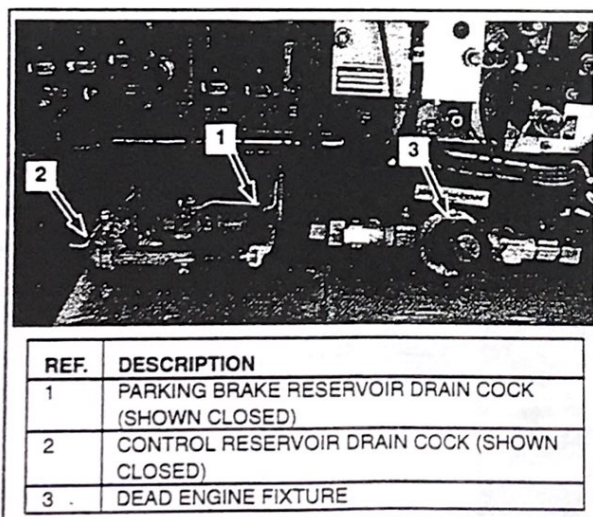


FIG. 27. CONTROL AIR AND PARKING BRAKE RESERVOIR CUT-OUT COCKS. E-42743.

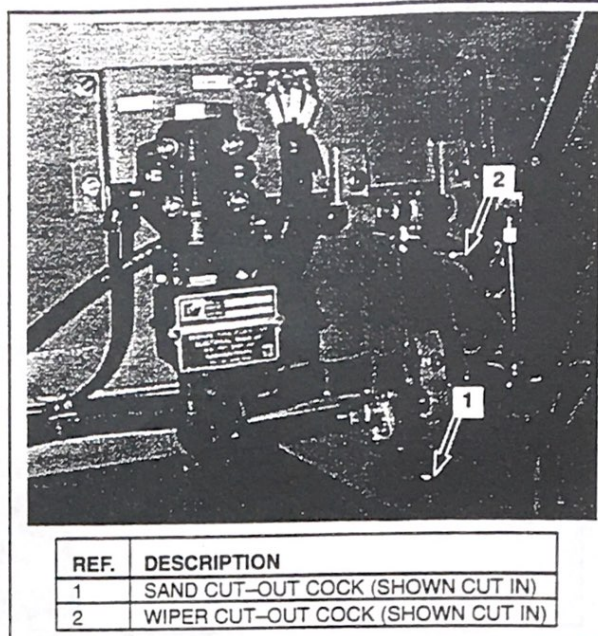


FIG. 28. FRONT SANDER AND WIPER CUT-OUT COCK. E-42744.

13. Truck (Brake Cylinder) Cut-Out cocks - Located on right side at each end of locomotive beneath locomotive platform level (Item 6, Fig. 30), one for each truck. A parking brake cut-out cock (Item 7, Fig. 30) is also supplied for both trucks (located adjacent to the brake cylinder cut-out cock).

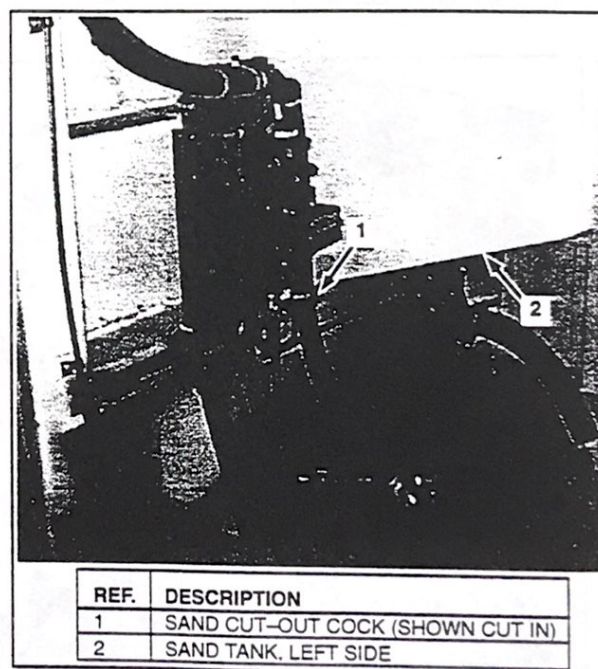


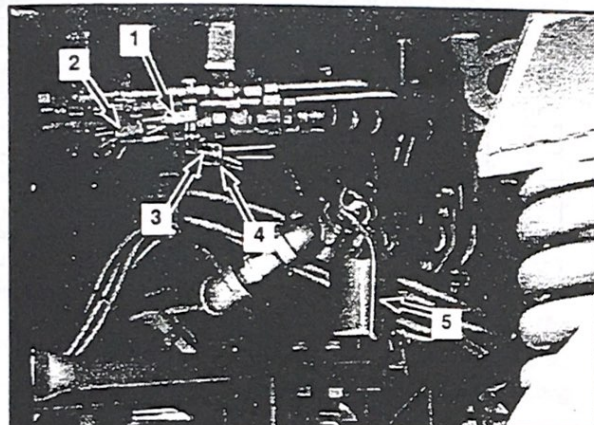
FIG. 29. REAR SANDER CUT-OUT COCK. E-42745.



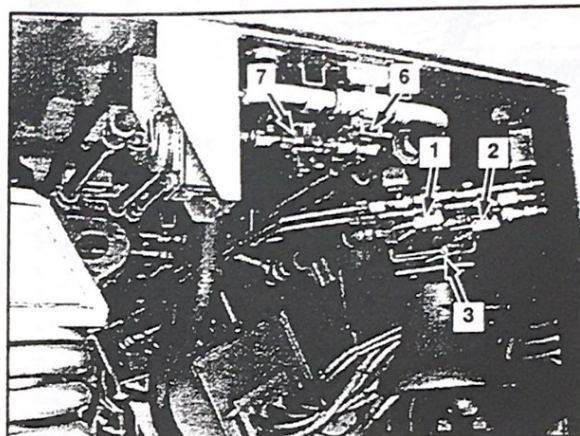
**NOTE:** The parking brake cut-out does NOT cut out the parking brake on the truck. Closing the cock releases the air from the parking brake units which causes the parking brakes to **APPLY** on the truck.

14. Cut-Out Cocks (Fig. 30), behind end plates, and End Connections at each end of locomotive (Figs. 31 and 32):

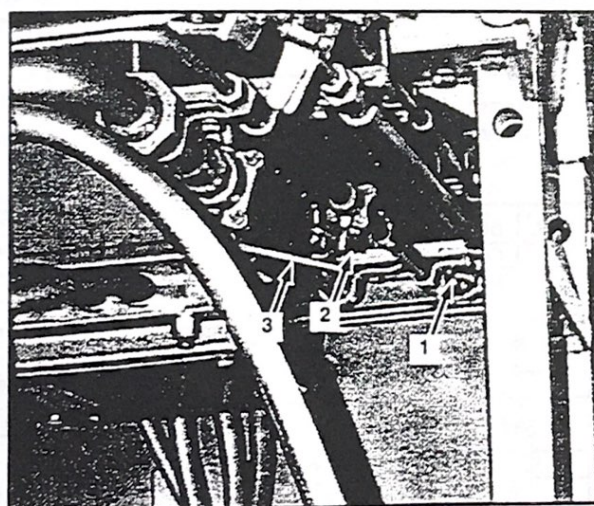
- Application and Release pipe cut-out cocks (Item 1, Fig. 30).
- Actuating pipe cut-out cocks (Item 2, Fig. 30).
- Main Reservoir Equalizing pipe cut-out cocks (Items 3, Fig. 30).
- Main Reservoir (Item 4, Fig. 30).
- Brake pipe angle cock (Item 5, Fig. 30).



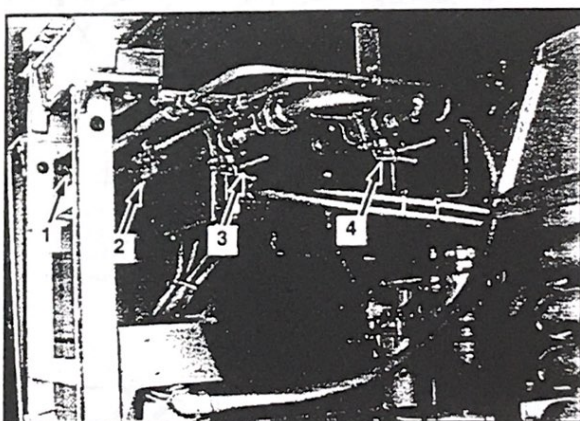
SHORT-HOOD END, LEFT SIDE



SHORT-HOOD END, RIGHT SIDE



LONG-HOOD END, LEFT SIDE



LONG-HOOD END, RIGHT SIDE

| REF. | DESCRIPTION                                 |
|------|---|
| 1    | APPLICATION AND RELEASE PIPE CUT-OUT COCK   |
| 2    | ACTUATING PIPE CUT-OUT COCK                 |
| 3    | MAIN RESERVOIR EQUALIZING PIPE CUT-OUT COCK |
| 4    | MAIN RESERVOIR CUT-OUT COCK                 |
| 5    | BRAKE PIPE ANGLE COCK                       |
| 6    | TRUCK (BRAKE CYLINDER) CUT-OUT COCK         |
| 7    | PARKING BRAKE CUT-OUT COCK                  |

FIG. 30. AIR PIPING LONG AND SHORT HOOD ENDS. E-42726.



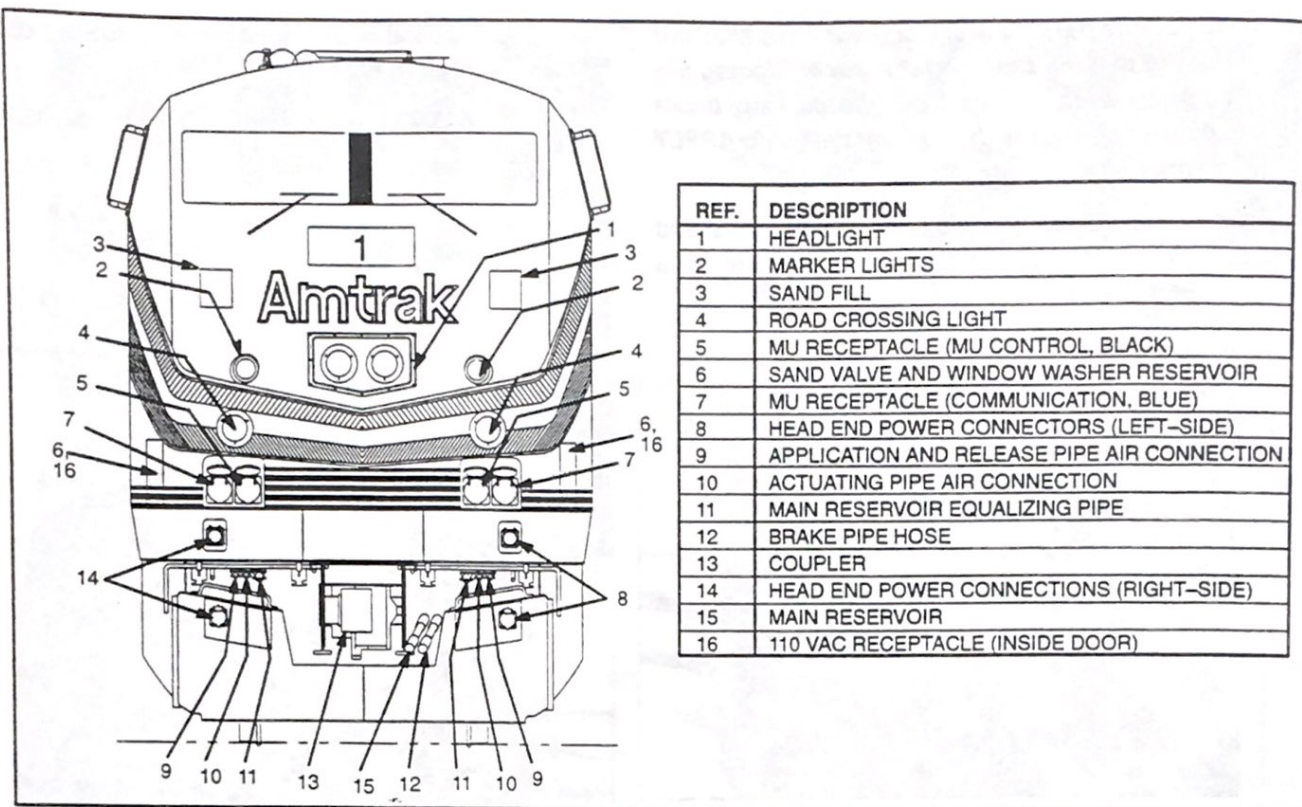


FIG. 31. LOCOMOTIVE SHORT-HOOD ASSEMBLY AND END CONNECTIONS. E-42572.

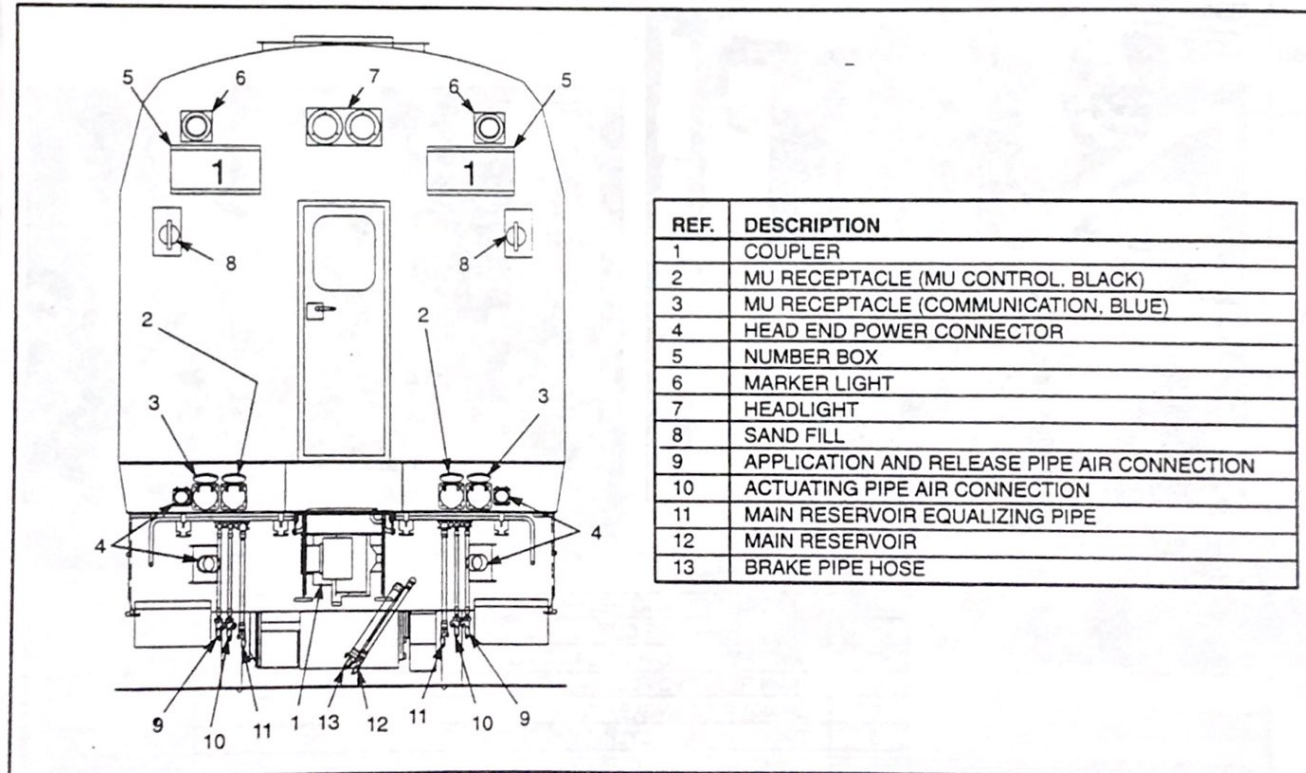


FIG. 32. LOCOMOTIVE LONG-HOOD ASSEMBLY AND END CONNECTIONS. E-42746.



## PARKING BRAKE

The P42-DC locomotive is not equipped with the conventional hand brake. It has a spring-applied, air-released parking brake. When the parking brake handle (Item 4, Fig. 10) in the operator's cab is moved to the RELEASED position, main reservoir air is sent to all eight parking brake units (four per truck). The main reservoir air pressure overcomes spring pressure to release the parking brake.

When the parking brake handle is moved to the APPLIED position, air is vented at the handle. When the air is vented, a large spring on each brake unit applies the parking brakes.

**NOTE:** The following procedure must be used when Brake Pipe or Main Reservoir pressure CANNOT be maintained on locomotive.

**NOTE:** When the unit is hauled Dead-in-Train, with the Dead Engine Feature cut-in, the parking brake will function normally as long as brake pipe pressure on the controlling locomotive is at or above 90 psig.

To isolate (manually release) the parking brake, proceed as follows:

**WARNING:** Chock wheels. Once parking brake is manually released, it can only be applied again if main reservoir air is supplied to the locomotive or dead engine feature is cut-in with brake pipe pressure set at or above 90 psig on locomotive.

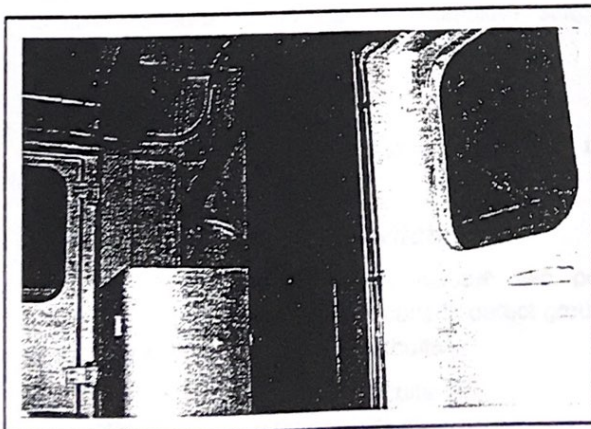


FIG. 33. SPECIAL TOOL LOCKER IN RADIATOR COMPARTMENT. E-42747.

1. Place parking brake handle (Item 4, Fig. 10), located in the operator's cab, to the APPLIED position.
2. Use wrench (14 mm square) from special tool locker located at the back of the Radiator Compartment (Fig. 33).
3. Mechanically unlatch the parking brake at each brake unit. To manually release this spring-applied brake at the brake units, turn the square release nut with a wrench as shown in Fig. 34.

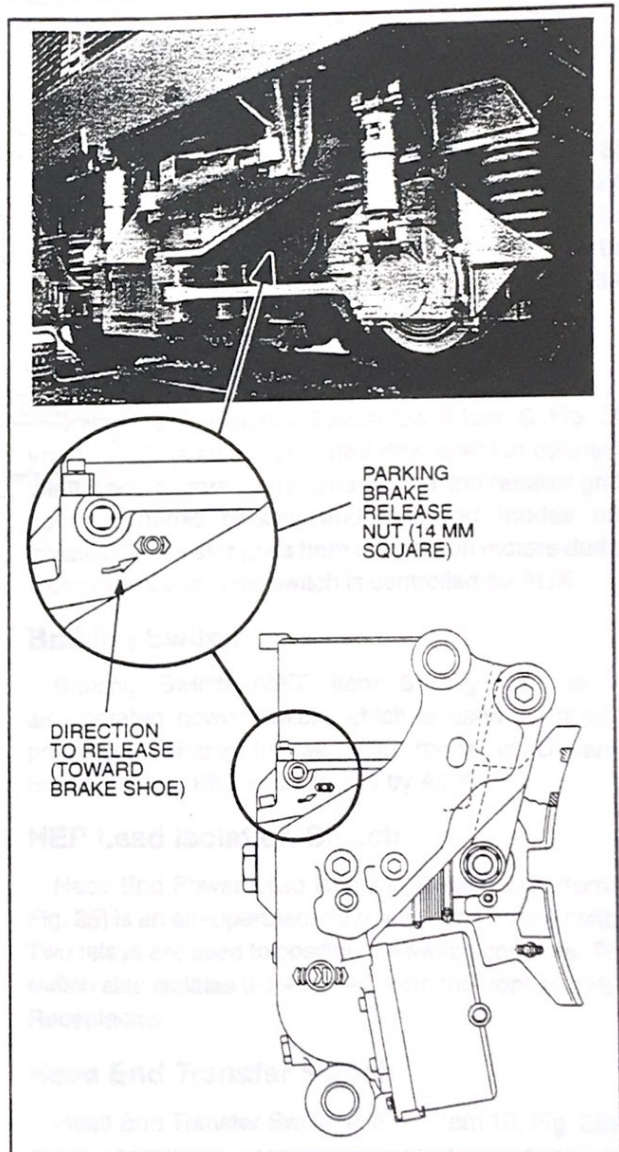
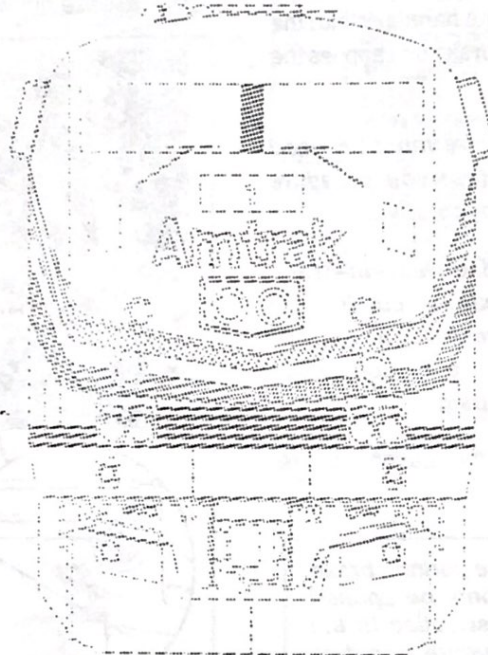


FIG. 34. PARKING BRAKE RELEASE NUT. E-42728.







## AUXILIARY COMPARTMENT EQUIPMENT

### INTRODUCTION

This section of the Operating Manual identifies and describes various locomotive control devices, gauges and other locomotive equipment that is located in the Auxiliary Compartment of the *P42-DC Locomotive*.

### TOILET COMPARTMENT

The Toilet Compartment is located near the auxiliary compartment on the right of the locomotive. Use the Flush Handle to manually pump water into the toilet.

### CONTROL COMPARTMENT EQUIPMENT

**WARNING: High voltage is present in this compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and SHUT DOWN HEP.**

Control lockers located in the operator compartment and the auxiliary compartment contain most of the control equipment. The control locker in the operator compartment is called Control Area 1. The auxiliary compartment, located directly behind the operator compartment, houses Control Areas 2, 3, 4 and 5. In addition, control equipment is located in Control Area 9 which is located in radiator compartment.

Following is a description of each device in the Aux compartment that can be manually reset. Refer to the Running Maintenance Manual for a complete listing of devices.

### CONTROL AREA 2

Control Area 2 contains equipment located on the forward end wall.

#### Ground Relay Cut-Out Switches

Ground Relay Cut-Out Switches are two pole switches that connect sensing circuits to detect ground leakage current in the following circuits:

- GRCO1 (1): Propulsion Circuits.
- GRCO2 (2): Excitation Circuits.
- GRCO3 (3): Auxiliary Circuits.
- GRCO4 (4): Battery Charger Circuits.
- GRCO5 (5): Head End Power Circuits.

### CONTROL AREA 3

Control Area 3 contains equipment located on the left side wall of the Aux Cab.

#### Control Air Pressure Gauge

This gauge (Item 13, Fig. 35) displays the control air pressure for operating control devices in the aux compartment. Normal pressure is 80 psig.

**NOTE: See TROUBLESHOOTING section to manually reset and operate these devices.**

#### Reverser

Traction Motor Field Reverser (REV Item 7, Fig. 35, and Fig. 36) is a motor-operated power switch used to reverse traction motor fields in order to change the locomotive direction. REV also provides isolation for the traction motors when they are cut-out. REV is controlled by AUX.

#### Brake Motor Switch

Brake-Motor-Isolation Switch (BMS Item 6, Fig. 35, and Fig. 37) is an air-operated device which connects the traction motors to the dynamic braking resistor grids during dynamic braking and self-load modes and isolates the resistor grids from the traction motors during motoring modes. This switch is controlled by AUX.

#### Braking Switch

Braking Switch (BKT Item 8, Fig. 35) is an air-operated power switch, which is used to transfer propulsion circuits for Motoring mode to Dynamic Braking mode. BKT is controlled by AUX.

#### HEP Lead Isolation Switch

Head End Power Lead Isolation Switch (LIS, Item 9, Fig. 35) is an air-operated, dual relay-controlled switch. Two relays are used to position the switch contacts. This switch also isolates the 480 VAC from the front end HEP Receptacles.

#### Head End Transfer Switch

Head End Transfer Switch (HETS, Item 10, Fig. 35) is an air-operated power switch, used to connect either the output of the Head End Alternator or the output of the Traction Alternator as a source of HEP. HETS is controlled by the HEP controller.



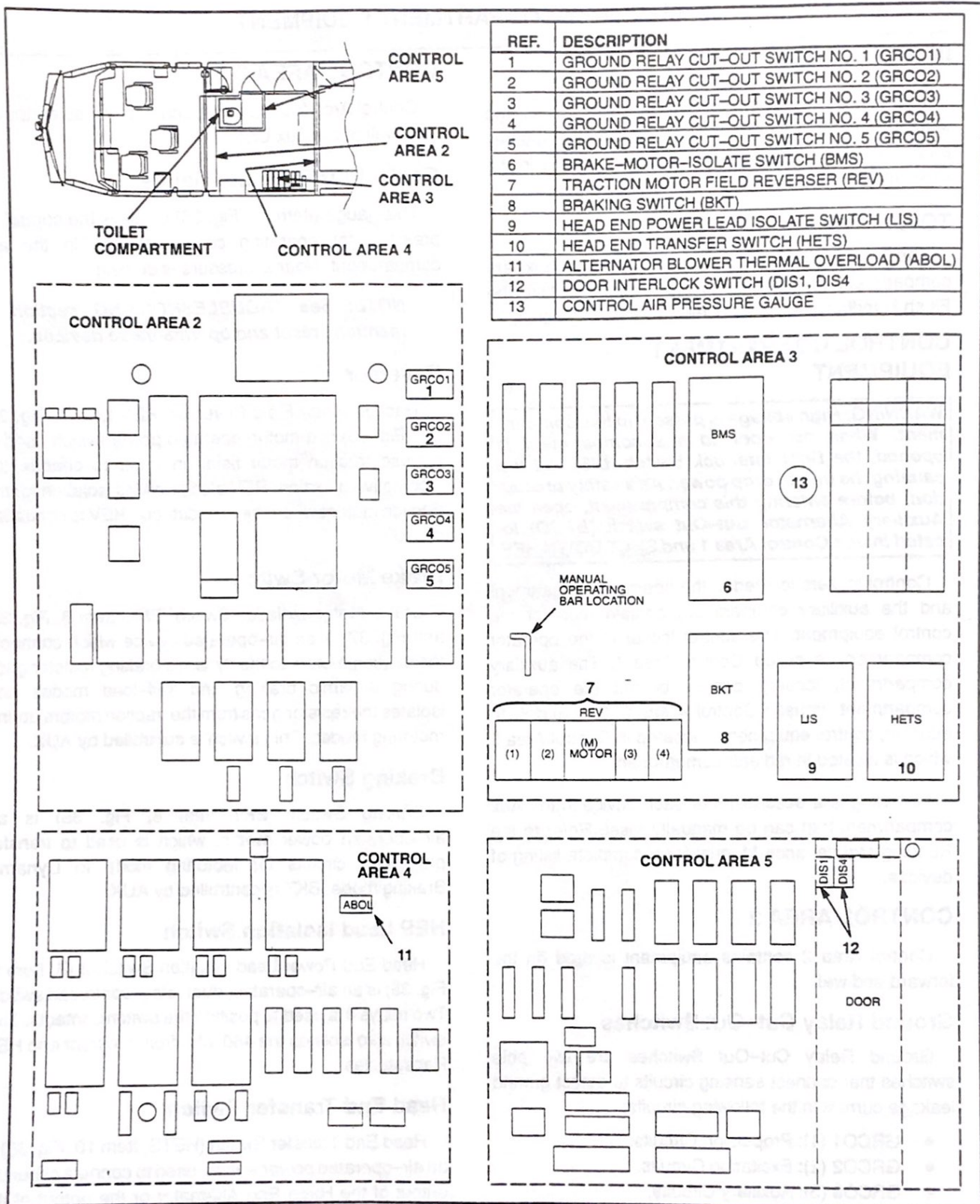


FIG. 35. AUX CAB EQUIPMENT. E-42718.



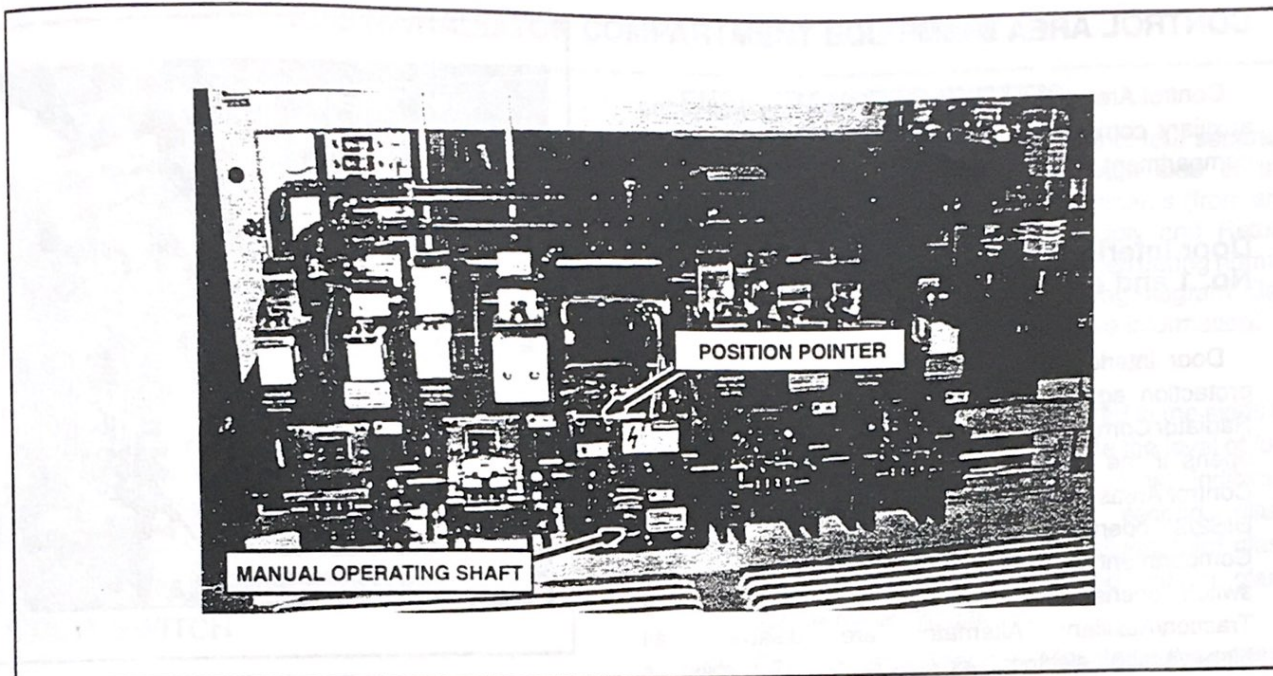


FIG. 36. REVERSER ASSEMBLY. E-42751.

## CONTROL AREA 4

The devices in Control Area 4 are located on the rear wall of the auxiliary compartment.

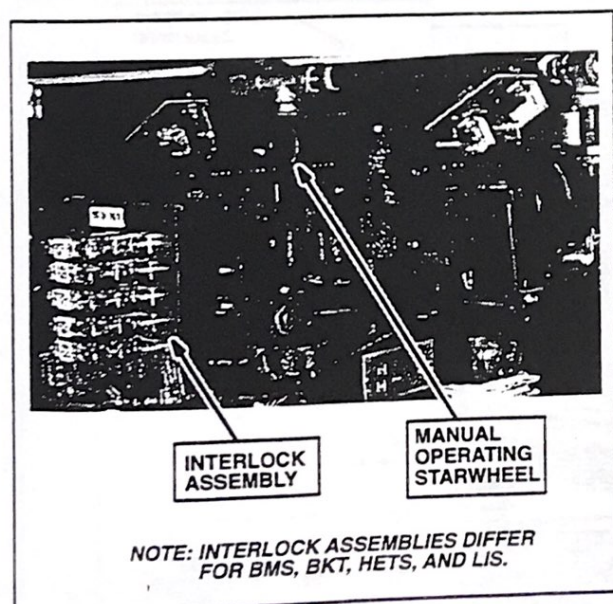


FIG. 37. POWER SWITCH FRONT END ASSEMBLY. E-42752.

## Alternator Blower Thermal Overload

Alternator Blower Thermal Overload (Fig. 35, 11 and Fig. 38) connects between each phase of the auxiliary alternator output and each phase of the alternator blower motor input. ABOL will open, or trip, if the current through any phase becomes excessive for an extended period of time.

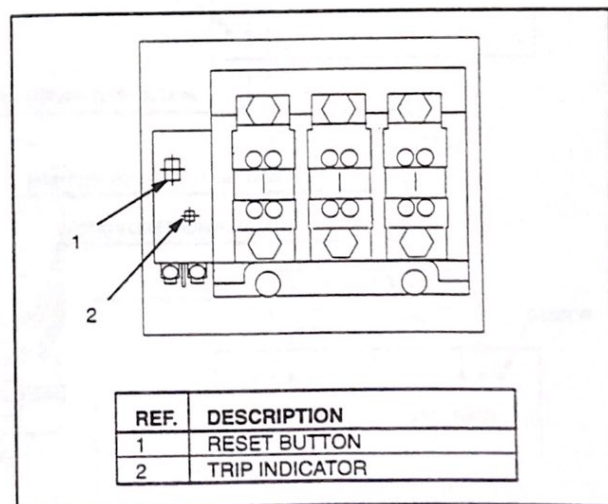


FIG. 38. ALTERNATOR BLOWER THERMAL OVERLOAD RESET. E-42753.



## CONTROL AREA 5

Control Area 5 is located on the right side wall of the auxiliary compartment and the backside of the toilet compartment.

### Door Interlock Switches No. 1 and No. 4

Door Interlock Switches (DIS) are used for safety protection against high-voltage in the Auxiliary and Radiator Compartments. DIS1/4 (Fig. 35, 12 and Fig. 39) opens if the access door to Auxiliary Compartment Control Areas CA2, CA3, CA4 and CA5 is opened, and DIS2/3 opens if the access door to Radiator Compartment Control Area 9 is opened. When either switch opens, the Head End Alternator and the Traction/Auxiliary Alternator are disabled: all high-voltage electrical power (above 74 volts) is removed from the Auxiliary and Radiator Compartments.

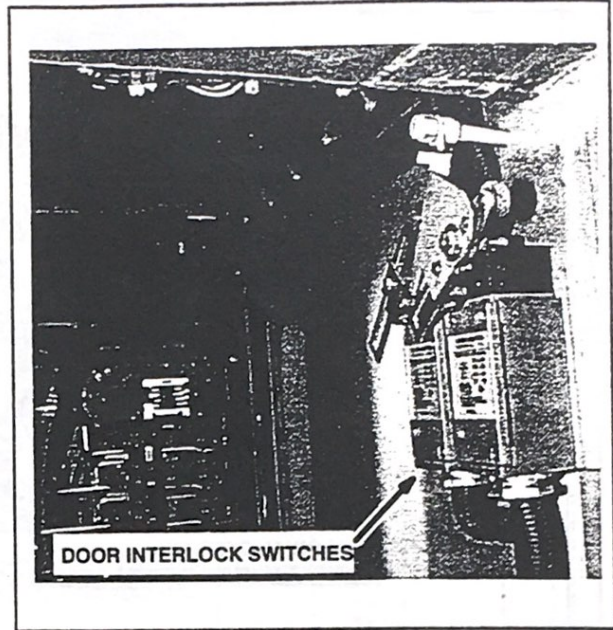
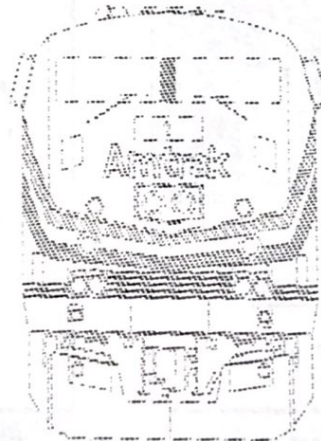


FIG. 39. DOOR INTERLOCK SWITCH. E-42750.





## ENGINE/RADIATOR COMPARTMENT EQUIPMENT

## INTRODUCTION

This section of the Operating Manual identifies and describes various locomotive control devices, gauges and other locomotive equipment that the operator may need to interface with during operation of the *P42-DC Locomotive* in the Engine and Radiator Compartments.

**WARNING:** Falls while moving between equipment can cause severe injury or death. This locomotive has no rear platform because of limited clearances. Use extreme caution when passing between locomotive and adjacent equipment. Pass only in accordance with railroad procedures.

## ENGINE START STATION AND START SWITCH

The Engine Start Station (Fig. 42) is located in the engine compartment next to the main traction alternator. It consists of an engine PRIME/START switch, operating in conjunction with the EC switch located in the cab, which is used to start the diesel engine, and an ENGINE STOP pushbutton.

## FUEL TRANSFER SYSTEM

The locomotive fuel tank is divided into four separate compartments. The fuel tank on each side of the locomotive is divided into two compartments (front and rear). Each compartment has a Supply and Return shutoff valve. These valves **must be** open during normal operation. See Fig. 40 for fuel oil piping diagram. See TROUBLESHOOTING section for more information.

## Fuel System Gauges

1. Fuel-Oil Sight Glasses – Mounted in the sides of the fuel tanks (Fig. 41) to indicate the level of fuel in the tanks. Top glass (per tank) indicates approximately 500 gallons, second glass indicates approximately 315 gallons, third glass approximately 150 gallons and bottom glass approximately 30 gallons.
2. Fuel-Oil Digital Readout – Mounted in the sides of the fuel tanks (Fig. 41). Total fuel approximation is calculated by adding the readings from the two sensors then multiplying by two.

**NOTE:** The following values are nominal because of varying conditions.

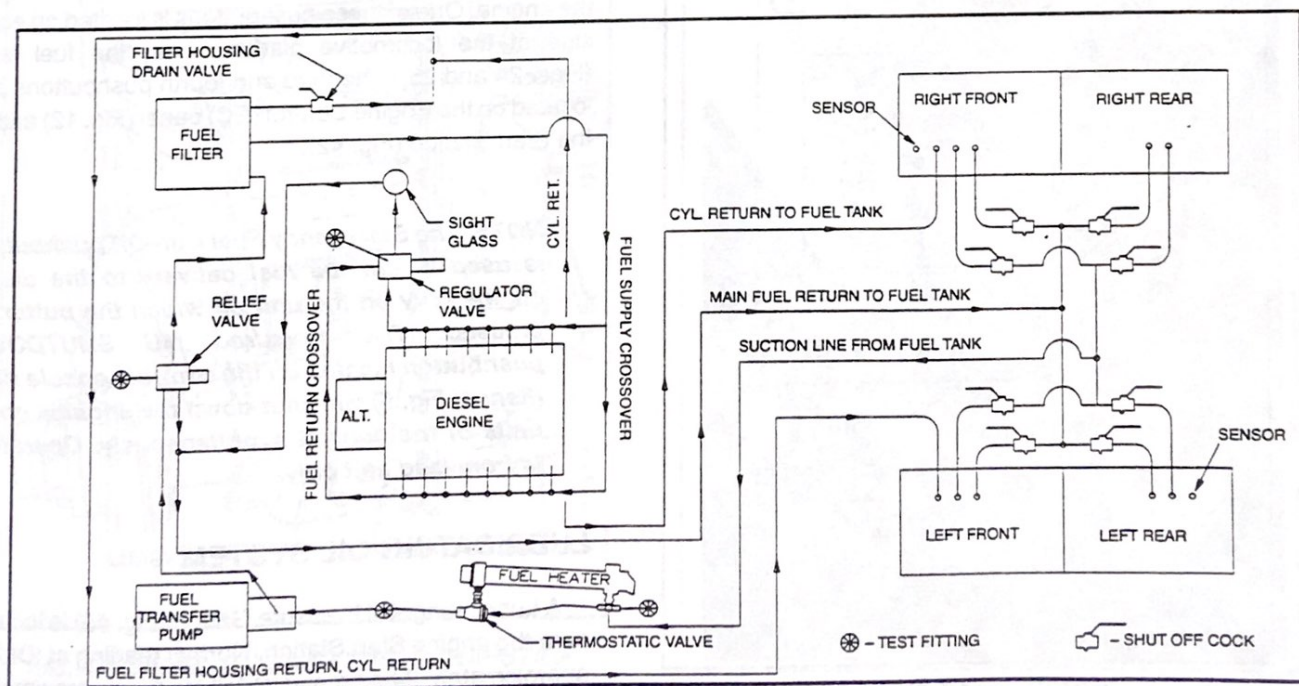


FIG. 40. FUEL OIL PIPING DIAGRAM. E-42755.



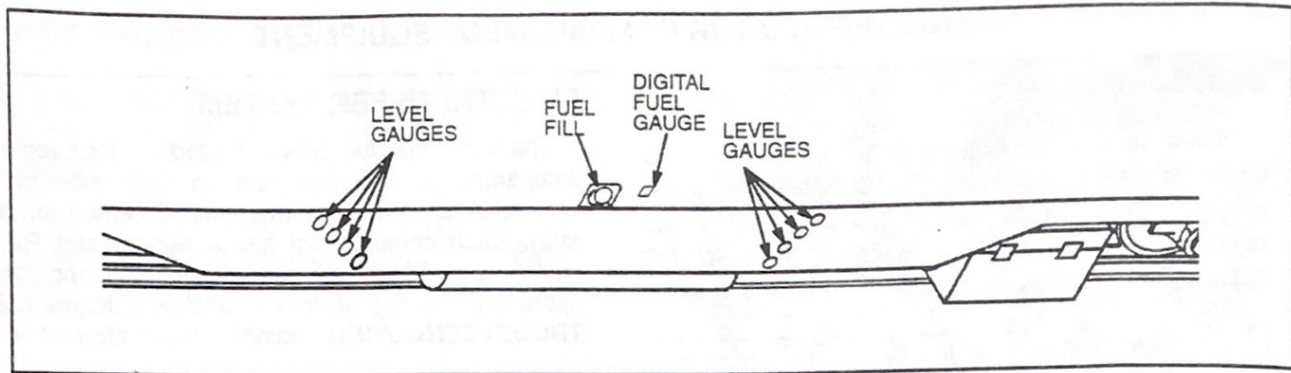


FIG. 41. FUEL FILL AND LEVEL GAUGES (LEFT SIDE). E-41065A.

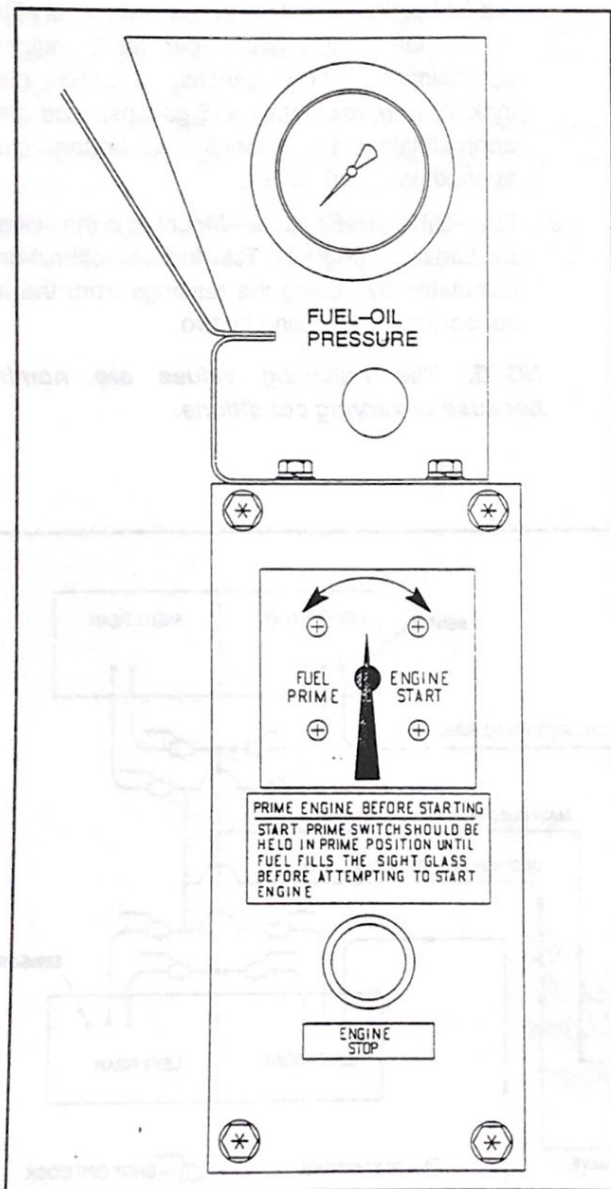


FIG. 42. ENGINE START STATION. E-41063.

3. Fuel-Oil Pressure Gauge (Fig. 42) – Located above the engine Start Station. Normal reading at IDLE is approximately 50–55 psig.
4. Turbo-Air Pressure Gauge (Fig. 43) – Located near the engine Start Station. Normal reading at full engine speed and full load is approximately 30 psig.

### Engine Stop and Emergency Fuel Cut-Off System

In an emergency, any one of four electric pushbuttons may be depressed momentarily to cut off fuel delivery to the engine. One of these pushbuttons is located on each side of the locomotive platform near the fuel tank (Figs. 24 and 25). The third and fourth pushbuttons are located on the Engine Control (EC) panel (Fig. 12) and at the Start Station (Fig. 42).

**NOTE:** The Emergency Fuel Cut-Off pushbutton is used to cut the fuel delivery to the diesel engine only on the unit on which the button is pressed. The green/red MU SHUTDOWN pushbutton located on the control console right (Item 4, Fig. 5) will shut down the engines on all units of the consist simultaneously. Operation is from lead unit only.

### LUBRICATING OIL SYSTEM

A Lubricating-Oil Pressure Gauge (Fig. 43) is located near the engine Start Station. Normal reading at IDLE is approximately 30 psig and at full load is approximately 100 psig.



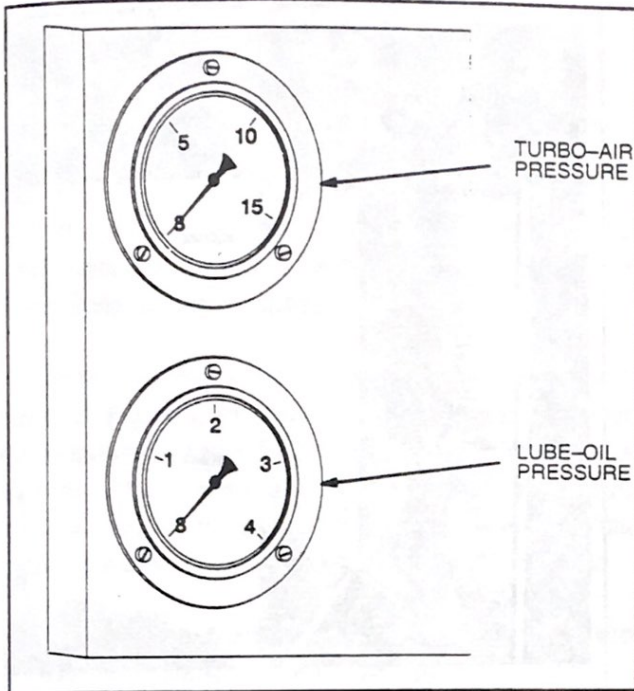


FIG. 43. GAUGE PANEL IN ENGINE COMPARTMENT. E-41135.

An Engine Lubricating-Oil Dipstick is located on both sides of the engine near the lubricating-oil fill (Fig. 44). The stick is marked FULL and LOW. Proper level with the engine idling is between FULL and LOW.

**NOTE:** Overfilling will cause engine to go to IDLE from excessive crankcase pressure.

### SUMMER/WINTER DOORS

Summer/Winter doors (Fig. 45) are located on the engine air filter box and can be manually operated to provide air from the engine compartment when air inlets are blocked with ice or snow. These doors can also be opened to provide "warm" air, temperature greater than ambient, to the engine.

**CAUTION:** Summer/Winter doors must remain closed when ambient temperature is above freezing 32° F (0° C). Failure to do so can derate equipment or cause equipment failure.

**NOTE:** It is recommended to keep Summer/Winter doors closed at all times and open only when absolutely necessary.

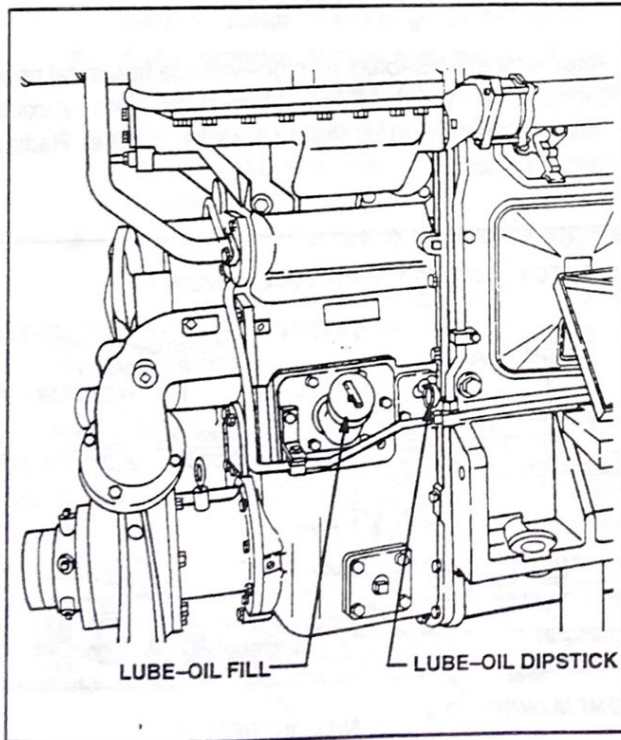


FIG. 44. DIESEL ENGINE LUBE-OIL DIPSTICK AND FILL. E-32795A.

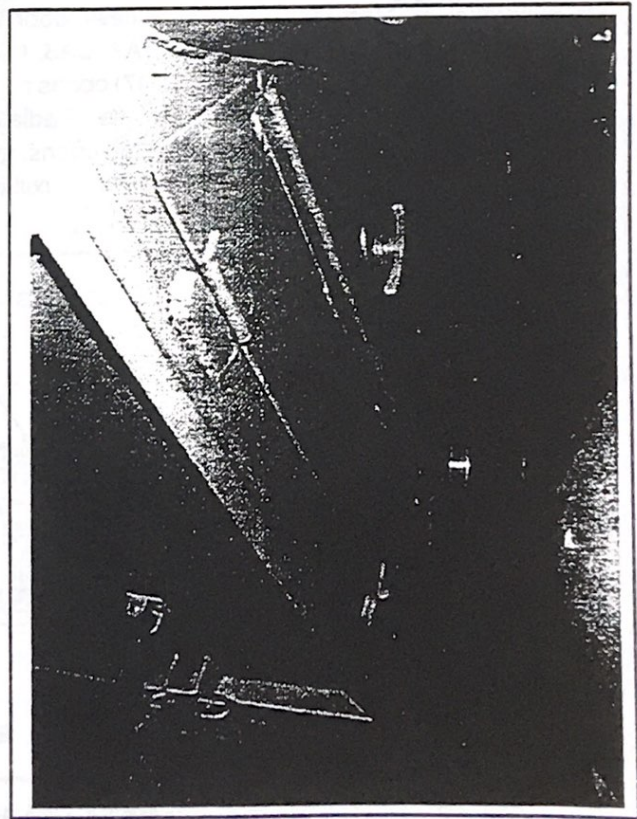


FIG. 45. SUMMER/WINTER DOORS. E-42758.



## RADIATOR COMPARTMENT EQUIPMENT

### Control Equipment Area 9 Located In The Radiator Compartment

**WARNING:** High voltage is present in Control Area 9. When the door to Control Area 9 is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before opening the door to this area, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and **SHUT DOWN HEP.**

Control Area 9 is located in the radiator compartment between the air compressor and equipment blower number 2 (Fig. 46) on the right side of the locomotive. The compressor control panel (Figs. 21 and 46) is also located between the air compressor and equipment blower no. 2, but on the left side of the locomotive

### Door Interlock Switches (Nos. 2 & 3)

Door Interlock Switches (DIS) are used for safety protection against high-voltage in the Auxiliary Compartment and Control Area 9 in the Radiator Compartment. DIS1/4 opens if the access door to Auxiliary Compartment, Control Areas CA2, CA3, CA4 and CA5, is opened. DIS2/3 (Item 1, Fig. 47) opens if the access door to Control Area 9 in the Radiator Compartment is opened. When either switch opens, the Head End Alternator and the Traction/Auxiliary

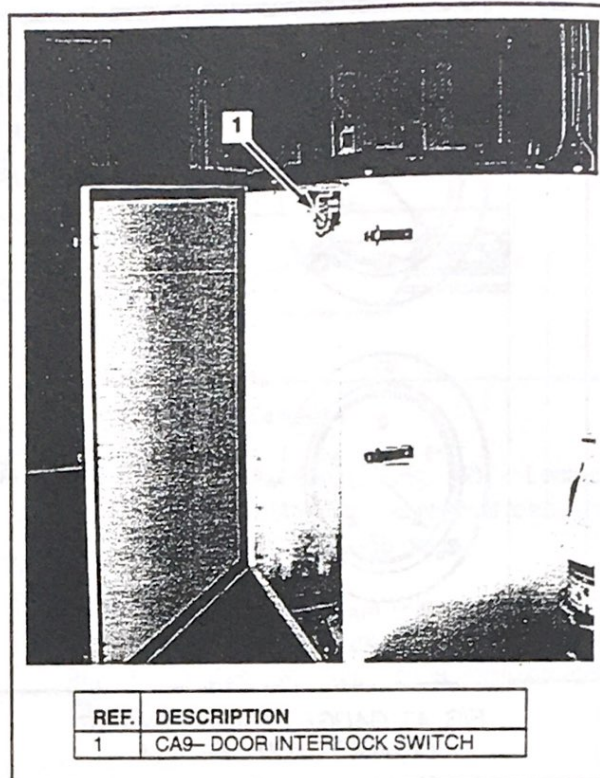


FIG. 47. CONTROL AREA 9 – DOOR INTERLOCK SWITCH. E-42780.

Alternator are disabled: all high-voltage electrical power (above 74 volts) is removed from the Auxiliary Compartment and Control Area 9 in the Radiator Compartment.

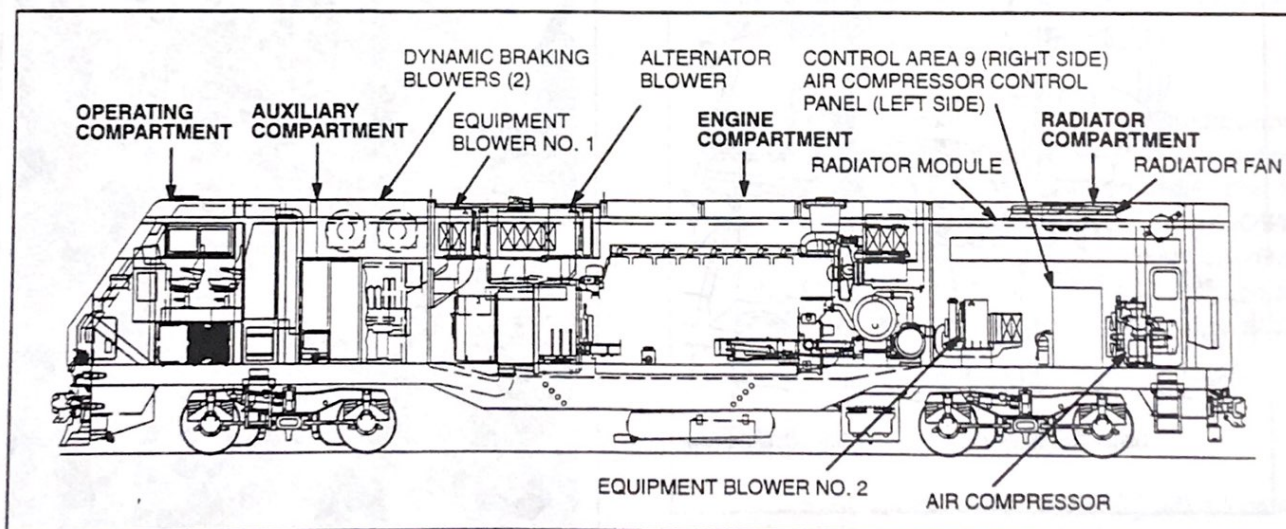


FIG. 46. LOCATION OF EQUIPMENT, DYNAMIC BRAKING AND ALTERNATOR BLOWERS AND RADIATOR COMPARTMENT EQUIPMENT. E-42577.



## EQUIPMENT BLOWERS AND RADIATOR FAN

This locomotive uses two electric motor-driven traction motor blowers, one motor-driven alternator blower and a motor-driven radiator fan. (See Fig. 46.) Only the alternator blower is not speed-controlled by solid-state electronics. The blower speed is directly proportional to engine speed.

A Fan Reverse switch, located in Control Area 1 (Item 25, Fig. 13), can be used to operate the radiator fan in reverse direction for a period of 60 seconds. This is to help clear leaves and debris which could have accumulated on the inlet screens and radiators. This switch is intended for use by maintenance personnel.

**NOTE:** For traction motor blowers and the radiator fan, note the following:

1. If cooling water temperature is below 150 F, the traction motor blowers go to full speed to draw load and warm the engine.
2. If ambient temperature is above 130 F, the traction motor blowers go to full speed.
3. If the radiator fan is not operated for a period of 30 minutes, the controllers will automatically operate it at full speed for a period of 10 seconds to prevent bearing brinelling.
4. If the fan has been cycling excessively, the fan will go to full speed.

## COOLING WATER SYSTEM

A water level sight glass mounted on the back side of the cooling water storage tank (Fig. 48) indicates the level of the cooling water. Markings near the sight glass indicate the proper level for various conditions of the system. Check cooling water level after engine has been idling for ten (10) minutes or more. Add water if level is below "LOW AT IDLE" mark. Reduce water by draining some of it if level is above "FULL AT IDLE" mark.

## Adding Cooling Water

**CAUTION:** Prior to adding water, **ALWAYS** relieve any system pressure by opening the vent valve (red handle) for 60 seconds. Close the vent valve by releasing handle.

1. Attach the water hose to the radiator fill carrot.
2. Pull down spring loaded radiator fill valve handle.
3. Turn on the water pressure.
4. Hold valve down until water level in the sight glass reaches "FULL AT IDLE" mark.
5. Release the radiator fill valve handle slowly.
6. Shut off the water pressure.
7. Remove the supply hose.
8. Open radiator fill valve to allow any trapped water to drain to prevent freeze up.
9. Start Engine. Idle ten (10) minutes.
10. Check for leaks.

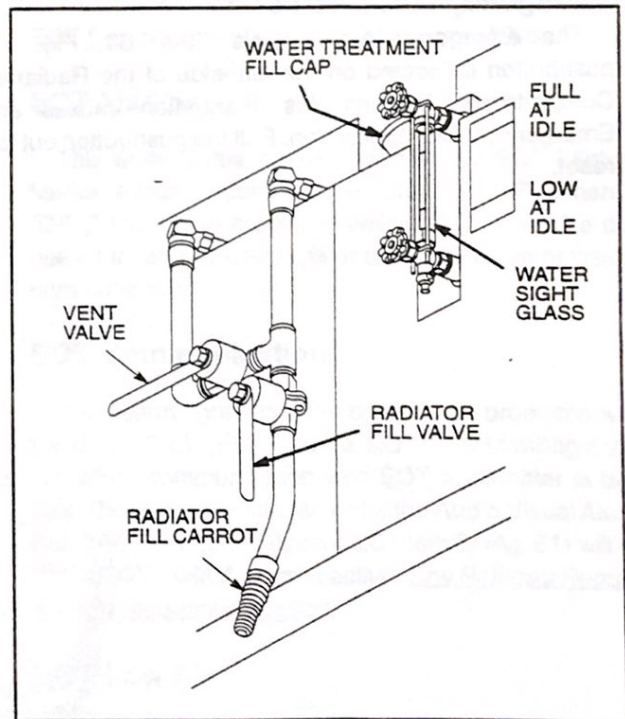


FIG. 48. ENGINE COOLING WATER SIGHT GLASS AND FILL. E-41064A.



## Draining Cooling Water

**WARNING:** To avoid personal harm from engine cooling water burns, when the water level is above **FULL AT IDLE** mark, **NEVER** remove the water fill cap. If over-full, open manual drain valve (near water pump) to reduce the water to a safe level.

The cooling water system may be drained (Item 1, Fig. 49) by opening the main water drain pump valve on the right side of the locomotive near the water. Drain cooling water in accordance with Railroad Rules and Procedures.

**CAUTION:** During freezing weather, protect the engine cooling system according to railroad instructions.

## MISCELLANEOUS EQUIPMENT

### Emergency Brake Valve

The emergency brake valve (Item 54, Fig. 1) pushbutton is located on the left-side of the Radiator Compartment. Pushing this pushbutton causes an Emergency brake application. Pull the pushbutton out to reset.

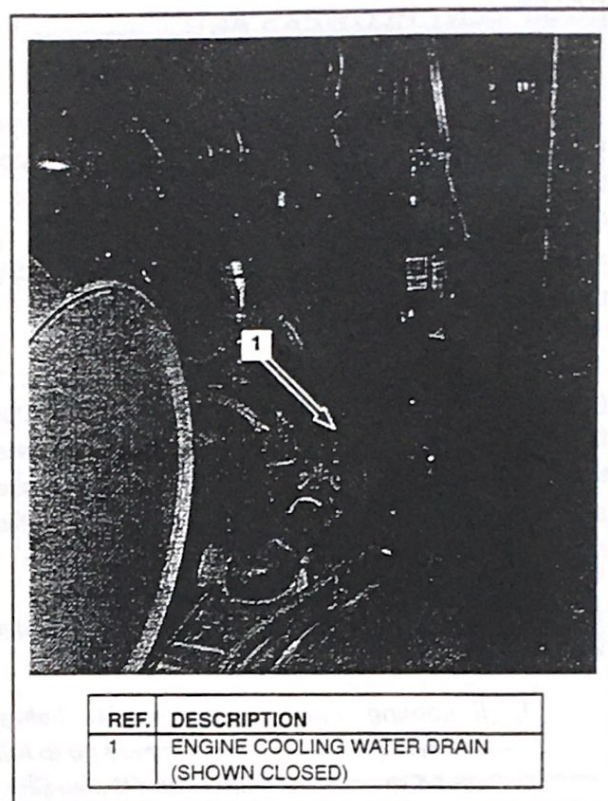
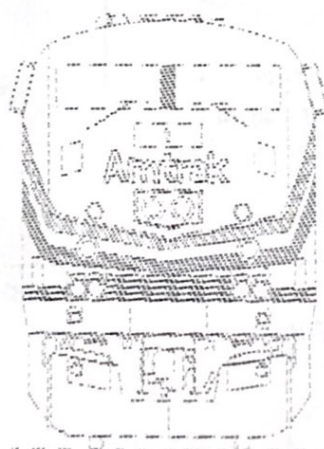


FIG. 49. ENGINE COOLING WATER DRAIN.  
E-42759.





## END OF TRAIN SETUP

### INTRODUCTION

The End Of Train monitor receives data from the rear-of-train-mounted transceiver. The EOT function monitors safety and handling information on the last car and transmits this data via radio link to a receiver in the cab of the lead locomotive. The information is displayed on the IFD (Fig. 51). This function allows the operator to view pertinent system data and ensure adequate notification on trainline breaks.

### INSTALLATION

The EOT monitor is installed in the operator's compartment control locker (CA1 Item 11, Fig. 13) located behind the center position seat. The monitor fits in a holder at the bottom of the door (Fig. 50). The power cable and communication cable are connected to

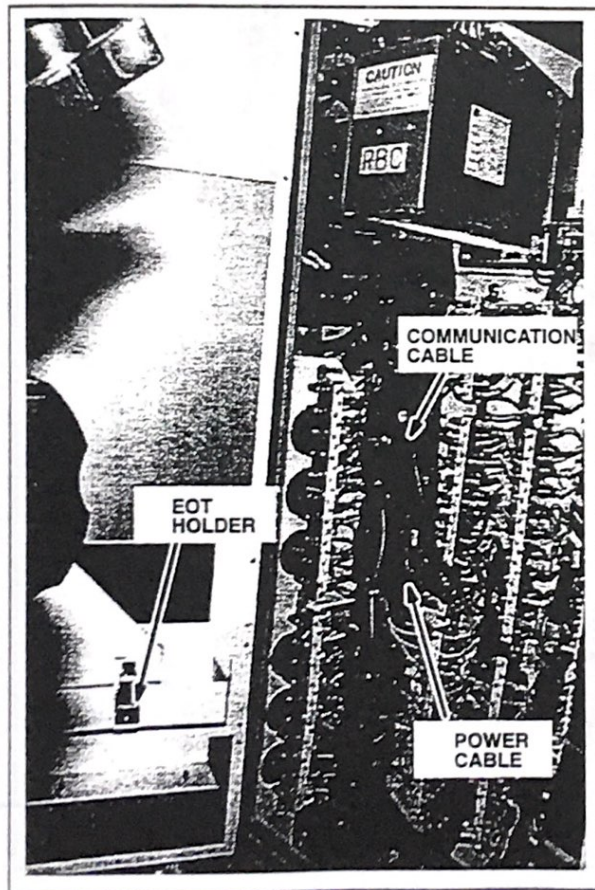


FIG. 50. END OF TRAIN SETUP. E-42756.

dummy receptacles. After the EOT monitor has been installed in the holder, connect the power and communication cable. EOT can then be set up using the IFD screen.

### SCREEN INDICATIONS

(Refer to Fig. 51.)

#### EOT Emergency Status

This message window indicates the Two-Way EOT status. Indications are: "Enabled," "Disabled," "One Way" or "\*\*\*\*." The "\*\*\*\*" indicates an out-of-range or unknown condition while the yellow "Disabled" indicates an alarm (or operator take note) condition.

#### Last Car

This status marker indicates movement status of the EOT Device. Indications are: "Moving" or "Stop."

#### EOT Marker

This white status marker indicates the EOT Lantern Marker status. Indications are "ON" or "OFF". When in "OFF," the status marker is yellow. A "\*\*\*\*" will be displayed for an out-of-range or unknown value or loss of communication.

#### EOT Communication

This alarm light indicates component problems with the End of Train (EOT) device. EOT COMM will light yellow when communication with EOT transmitter is broken. The computer will also order the Audio Visual Alarm Box (AVB) to beep. Value for LC (Item 5, Fig. 51) will be "\*\*\*\*" if EOT COMM alarm is active. See Railroad Regulations for appropriate action.

#### EOT Low Air

This alarm light indicates that the last car brake pipe pressure has fallen below 45 psig.

#### EOT Valve

This alarm light indicates that the EOT valve is defective.



## EOT Battery

This alarm light indicates component problems with the End of Train (EOT) device. EOT BATT will light yellow when the EOT battery is weak and light red when dead. *See Railroad Regulations for appropriate action.*

## SETUP

**NOTE:** Only key position F8 (Exit) is available to the Crew Display.

Pressing key position F3, **EOT Setup**, on the Operator Function Screen (screen 300 000, see Fig. 62) will display screen 330 000. Follow Railroad procedures for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F1 (**Function On/Off**) toggles the End Of Train Function On/Off.
2. Pressing key position F2 (**EOT Setup**) will display screen 332 000 and allow the operator to change the End Of Train Setup. The active keys and a brief description of operation are as follows:

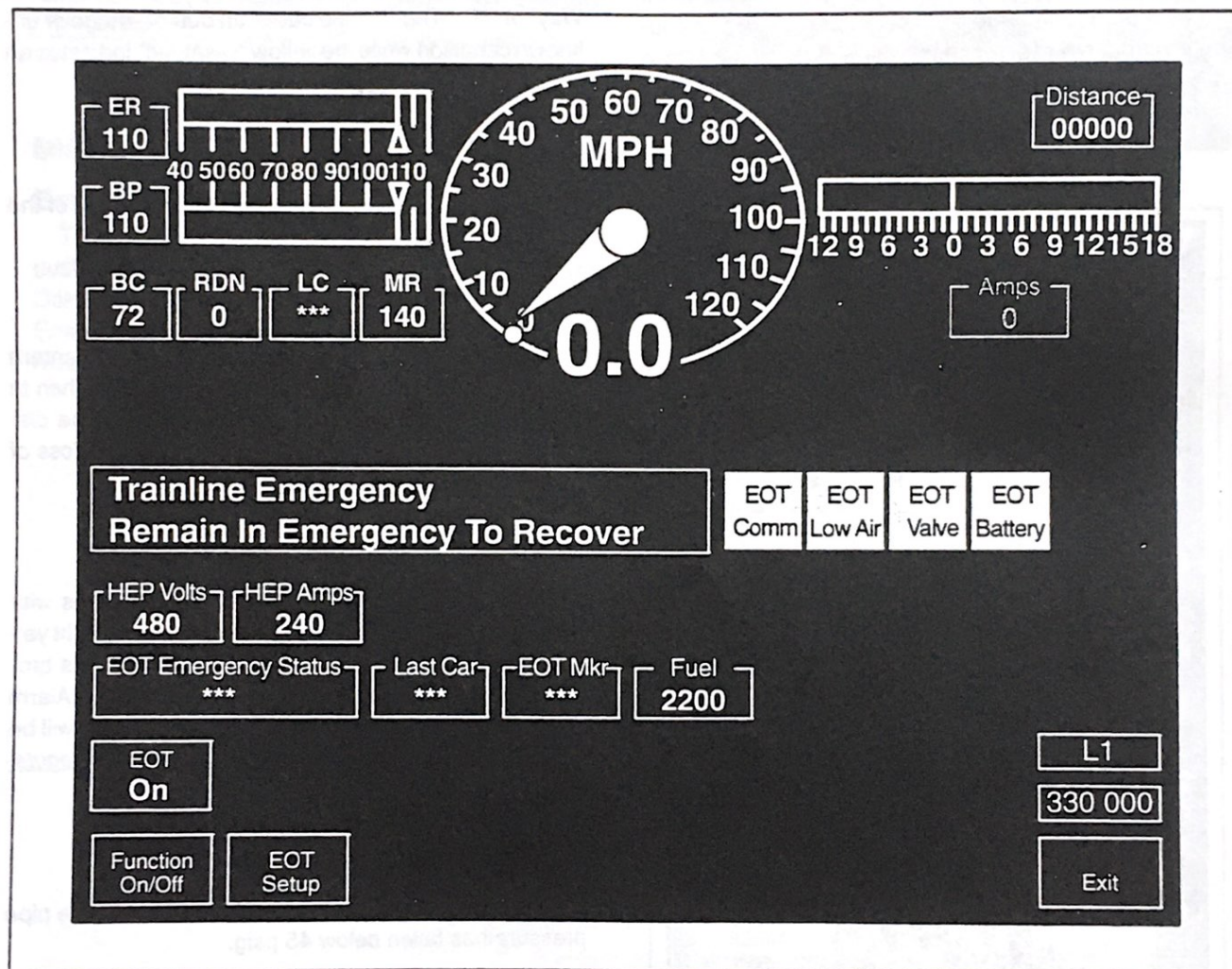


FIG. 51. END OF TRAIN OPERATING SCREEN (330 000). E-42585.



a. Press key position F1 through F5 ("**UP**" **Arrows**) will enable change of the Transmitter Code (**Xmtr Code**) by digit (marker and text will go yellow).

b. Key position F6 varies depending on system status as follows:

- 1) Upon entering screen 332 000, key F6 will read **EOT 00000**. Pressing this key will order the IFC computer to Disarm the EOT Device. Key F6 will disappear from the screen and key F7 will read **Disarm Two Way** (marker and text go yellow).

The EOT Status position will read "Disarm Now".

- 2) If one of the "**UP**" **Arrow** keys is pressed, key F6 will read **Enter Code**. The message line will read "Use Arrow Keys To Select EOT Code" (marker and text go yellow). Press key position F6 (**Enter Code**) will send the new code to the LCU (Locomotive Cab Unit).

c. Key position F7 varies depending on system status. See **Table 4**.

d. Pressing

3. Pressing **Exit** will return you to screen 300 000.

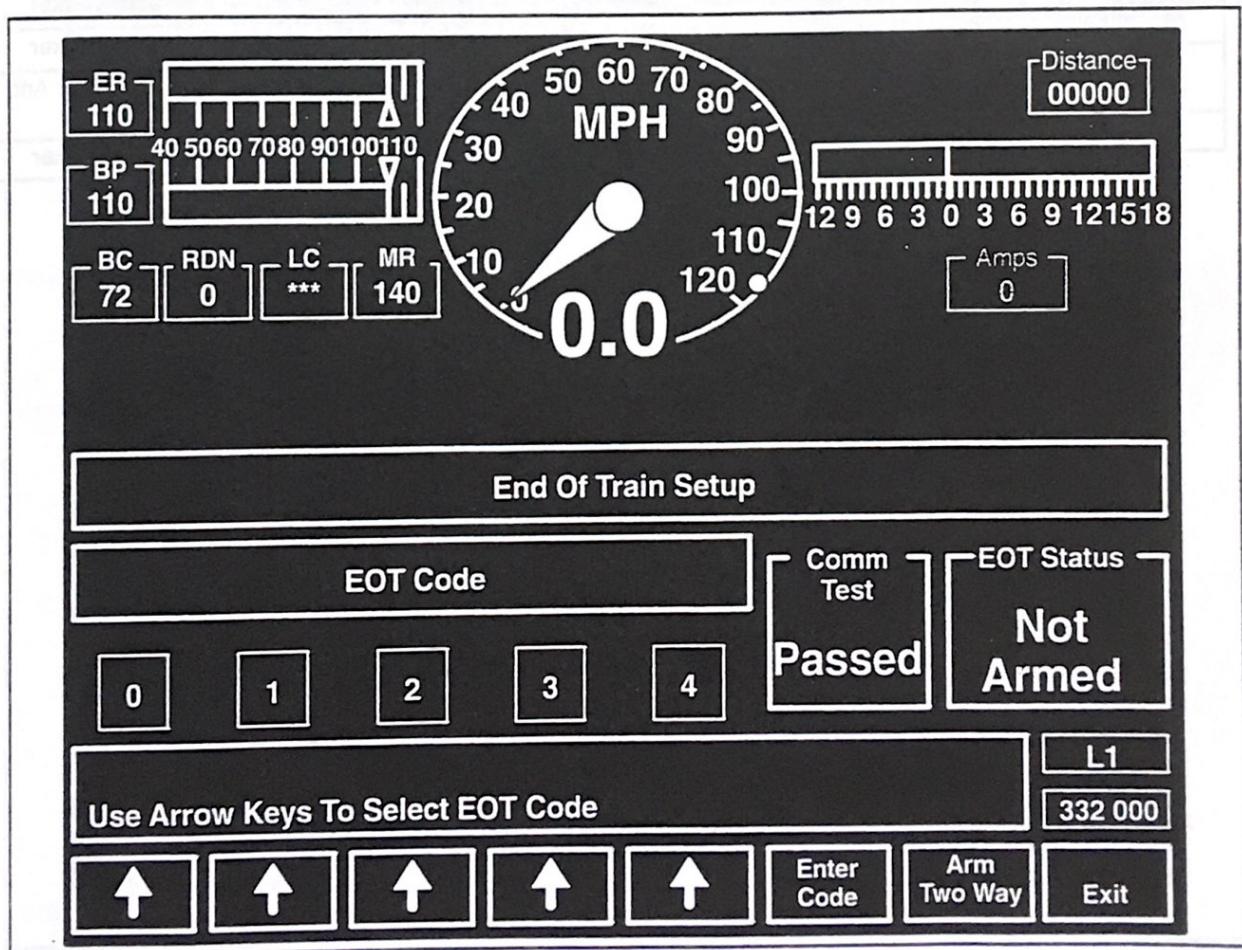
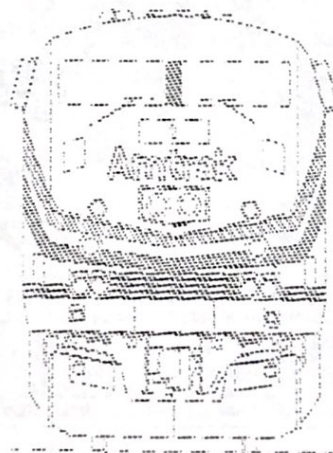


FIG. 52. END OF TRAIN SETUP SCREEN (332 000). E-42586.



TABLE 1. END OF TRAIN INDICATIONS.

| SBU DEVICE STATUS | EOT STATUS TEXT       | KEY F7 TEXT    | COMM TEST TEXT    | COMMENTS              |
|-------------------|-----------------------|----------------|-------------------|-----------------------|
| One Way           | System One Way        | [No Key]       | [Last Status]     | Normal Marker         |
| Armed             | System Armed          | Comm Test      | [Last Status]     | Normal Marker And Key |
| Not Armed         | System Not Armed      | Comm Test      | [Last Status]     | Normal Marker And Key |
| Disarmed          | System Disarmed       | Comm Test      | [Last Status]     | Normal Marker And Key |
| Armed Other       | Armed To Different ID | [No Key]       | [Last Status]     | Yellow Marker         |
| Arm Now           | Arm Now               | Arm Two Way    | [Last Status]     | Yellow Marker And Key |
| Disarm Now        | Disarm Now            | Disarm Two Way | [Last Status]     | Yellow Marker And Key |
| Test Running      | [Last Status]         | [No Key]       | Comm Test Running | Normal Marker         |
| Test Passed       | [Last Status]         | [No Key]       | Comm Test Passed  | Normal Marker         |
| Test Failed       | [Last Status]         | [No Key]       | Comm Test Failed  | Normal Marker         |
| Unknown           | System Unknown        | Comm Test      | [Last Status]     | Normal Marker And Key |
| ***               | ***                   | [No Key]       | [Last Status]     | Normal Marker         |





## SAFETY DEVICES

## CAB SIGNAL

## Introduction

The Cab Signal system provides a means by which wayside signal aspects are encoded into the running rails. The locomotive receives the information from the rails, the electronics interprets the coding and displays the signal aspect on the Aspect Display Panel. An additional function, Speed Control, assigns and enforces a speed limit for each aspect. The aspects and associated speed limits differ among railroads.

The Cab Signal system enhances train safety by applying a penalty brake application with PCS if the opera-

tor does not respond properly to signal changes and/or overspeed conditions within seven (7) seconds.

**NOTE: Only key position F8 (Exit) is available to the Crew Display.**

## Operation

## Cab Signal Test

Pressing key position F4, **Cab Signal**, on the Operator Function Screen (screen 300 000, see Fig. 62) will display screen 340 000. Follow Railroad procedures for this operation. The active keys and a brief description of operation are as follows:

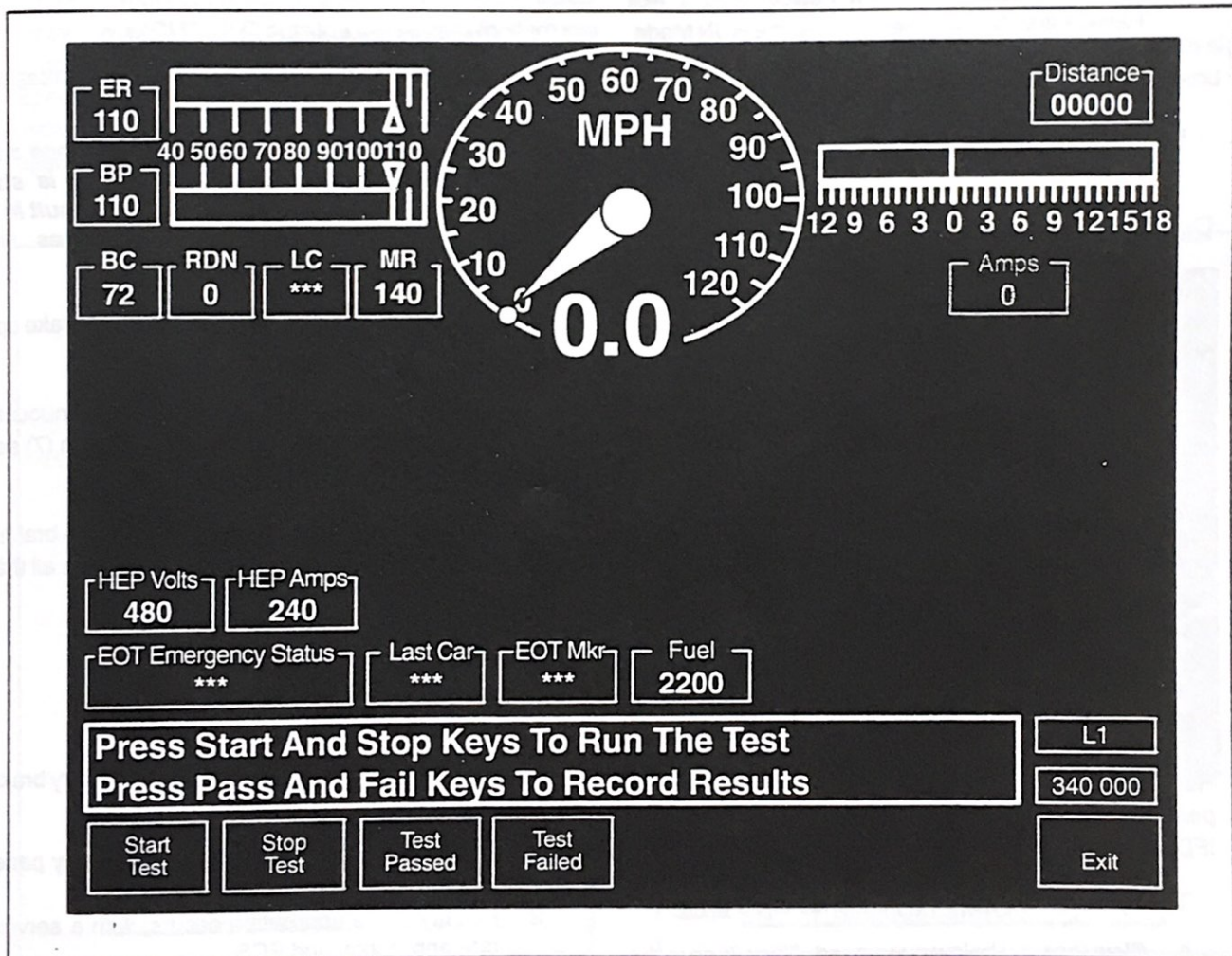


FIG. 53. CAB SIGNAL SCREEN (340 000). E-42587.



1. Press key position F1 (**Start Test**) will activate the cab signal system test program. The Summary Message Area will change from **Press Start and Stop Keys ... to Cab Signal Test Running**.
2. Press key position F2 (**Stop Test**) will deactivate the cab signal system test. This key is only active if the test is running.
3. After Summary Message Area displays **Cab Signal Test Complete** and the test was successful, pressing key position F3 (**Test Passed**) logs a Test Passed Fault. IFC will then request the RUN Mode. When Mode changes to RUN, the display will return to screen 300 000.
4. After Summary Message Area displays **Cab Signal Test Complete** and the test was not successful, key Position F4 (**Test Failed**) logs a Test Failed Fault. IFC will then request the RUN Mode. When Mode changes to RUN, the display will return to screen 300 000.
5. Pressing **Exit** will return the display to screen 300 000.

### Downward Aspect Change

When the aspect changes downward, the audio alarm on the Cab Signal Overspeed Alarm Panel (Fig. 55) sounds. The operator must respond by pressing the Acknowledge button (Item 16, Fig. 5), which will silence the alarm. Failure to acknowledge results in a penalty brake application.

### Upward Aspect Change

An upward aspect change requires no operator response.

### Overspeed

If the locomotive speed exceeds that allowed by the aspect, the following occurs: (1) Audio alarm sounds; (2) Red overspeed light flashes on cab signal overspeed panel; and, (3) Yellow overspeed alarm light flashes on IFD screen.

The operator has seven (7) seconds to do either:

1. Slow the train below overspeed. This silences the alarm and causes both red and yellow overspeed indicators to go out.
2. Make a suppression brake application. The "Cab Sig Suppr" screen indication will light. This silences the audio alarm. While the locomotive is still in overspeed, both alarm lights will flash. Once the speed is below the limit, the lights both go out. Failure to act will result in a penalty brake application. If the brakes are released while still overspeed, the audio alarm will sound, and penalty brake application will result

### Downward Aspect Change and Overspeed

If the aspect changes downward, and the new speed limit is less than the train speed: (1) Audio alarm sounds; (2) Red overspeed light flashes; and, (3) Yellow overspeed warning light flashes on IFD screen.

The operator has seven (7) seconds to do the following:

1. Press acknowledge pushbutton, AND
2. Move automatic brake handle to Suppression position.

**NOTE: Making the brake application alone will silence the alarm, but acknowledging is still required. Failure to acknowledge will result in a penalty brake application when brakes are released from suppression.**

Failure to act correctly will result in a penalty brake application.

Holding down the acknowledge button continuously will result in a penalty brake application in seven (7) seconds.

If a downward aspect change occurs while the brakes are already in suppression, acknowledgement is all that is required.

### Penalty Brake Application

(See **AIR BRAKE EQUIPMENT** section.)

Should the Cab Signal System induce a penalty brake application, the following will result:

1. Red light on cab signal overspeed display panel stays on continuously.
2. Penalty brake application occurs, with a service rate application and PCS.
3. Brake pipe will drop to about 10 psig.
4. Audio alarm is already sounding.



## Penalty Brake Recovery

(Refer to **AIR BRAKE EQUIPMENT** section.)

### Equipment

#### Aspect Display Unit

This unit (Fig. 54) provides a read-out of the Signal Aspect decoded from the rails. The switch on top (Item 1, Fig. 54) is used to select the host railroad and display the corresponding aspects (Item 2, Fig. 54) for it and set the respective speed limits. The blue VZ light (Item 3, Fig. 54) at the center bottom illuminates when the locomotive is less than about 2 MPH. Thus, this light should always be on when stopped and out when moving. Failure to go out when the locomotive is moving indicates the speed control function has failed, and should be reported in accordance with host railroad rules. Placing the top selector switch in "CUTOUT" puts the Cab Signal System into a dormant state. This returns the locomotive to IFC Speed Control, 82 or 92 MPH (regular overspeed or IITS overspeed, respectively). With this switch in CUTOUT, operators screen reads "Cab Signal Cutout."

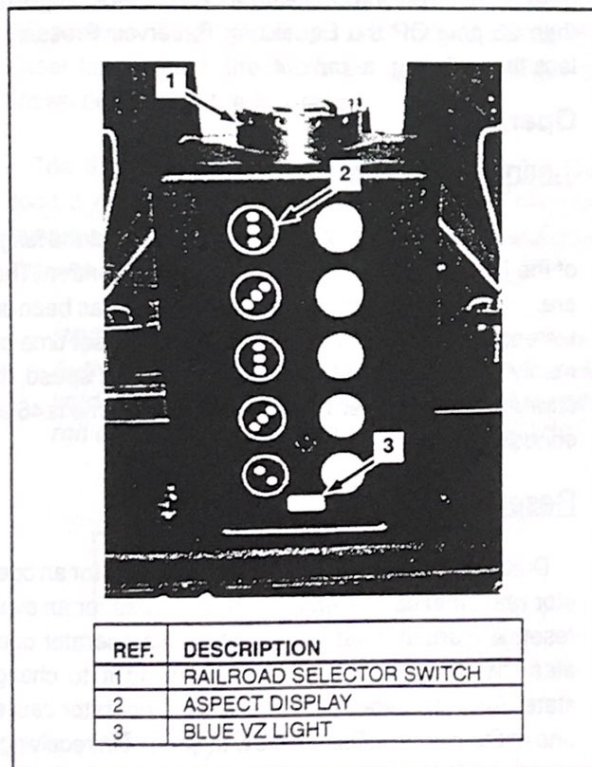


FIG. 54. ASPECT DISPLAY UNIT. E-42787.

## Cab Signal Overspeed Display Panel

Some functions are shared with IITS system; refer also to that section. It includes:

1. Red Overspeed Indicator (Item 1, Fig. 55)
  - a. Flashes on overspeed.
  - b. Lights continuously if penalty has occurred.
  - c. See IITS also.
2. Audio Alarm (Item 2, Fig. 55)
  - a. Sounds on downward aspect change and on overspeed.
  - b. See IITS also.
3. Territory Switch (Item 3, Fig. 55)
  - a. IN is used when operating in cab signal territory; speed control enforces aspect speed limits.
  - b. OUT is used when operating outside cab signal territory; speed control is via IFC, and is set at 82 MPH.

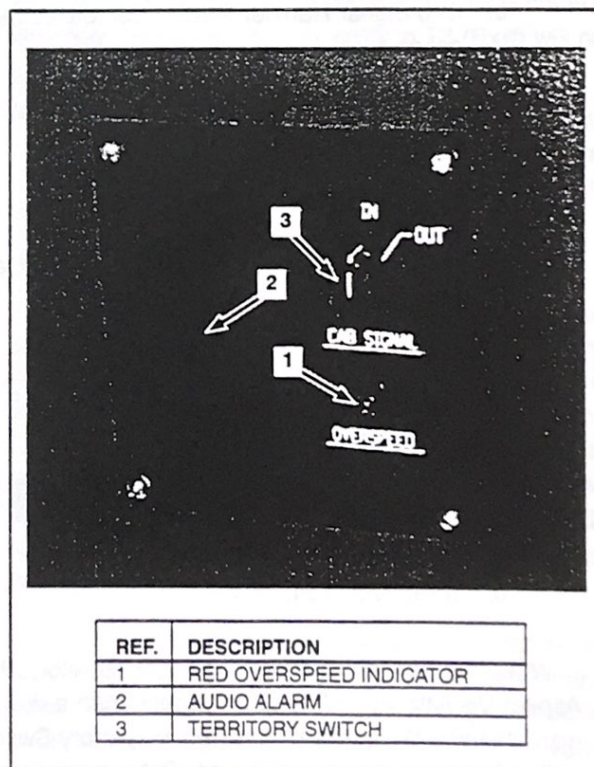


FIG. 55. CAB SIGNAL OVERSPEED DISPLAY PANEL. E-42786.



### Cab Signal Transfer Switch

The cab signal transfer switch (Item 40, Fig. 12) is used to determine whether the locomotive is operating in IITS (inductive train stop: Santa Fe) or cab signal mode.

### Cab Signal Cut-Out Switch

In cut-out position, this switch (Item 34, Fig. 12) prevents the Cab Signal System or IITS (whichever is selected by Cab Signal Transfer Switch) from inducing a penalty brake application. It does not disable the Aspect Display Unit nor speed control, only their ability to apply a penalty brake application. When in CUTOUT, the Cab Signal CUTOUT alarm light is illuminated on the IFD screen.

### **Setup**

1. Cab Signal Territory:
  - a. Cab Signal Circuit Breaker ON
  - b. Cab Signal Transfer Switch; Set to Cab Signal position
  - c. Aspect Display Unit Selector Switch set to proper railroad position
  - d. Territory Switch: IN
2. Non-Cab Signal Territory: (but later entering Cab Signal Territory)
  - a. Cab Signal Circuit Breaker ON
  - b. Cab Signal Transfer Switch: Set to Cab Signal position
  - c. Aspect Display Unit Selector Switch: Set to proper railroad position
  - d. Territory Switch: OUT

When the train encounters Cab Signal Territory, the Aspect Display Unit will read an aspect; then a downward change. When this occurs, move Territory Switch to the IN position and acknowledge. Cab signal will not acknowledge unless in territory switch is set to the IN position.

## **ALERTER**

### **Introduction**

The Alerter promotes safe train operation by monitoring various operator movements to ensure the alertness of the crew. If a proper control movement is not detected within a predetermined Reset time period, an alarm sequence including audible and visual alarms is started requesting an acknowledgement.

Lack of response to the system during this time will result in a penalty brake application. This action will command a full service brake application.

The two normal states of operation are the Active state and the Inactive state. If the alerter is inactive, a third state of operation (test) is available as long as the locomotive is not moving. The alerter is Inactive on power up. In the inactive and active states the alerter is in a loop checking to see whether or not the function should switch to the active or inactive state.

The alerter is active if the Brake Cylinder Pressure is less than or equal to 25 psig AND the Equalizing Reservoir Pressure is greater than or equal to 10 psig. The alerter is inactive if the Brake Cylinder Pressure is greater than 25 psig OR the Equalizing Reservoir Pressure is less than 10 psig, or cut out.

### **Operation**

#### Timing Sequence

There are two sets of conditions that affect the length of the Reset Time calculated by the IFC algorithm. They are: (1) Whether or not the first event reset has been detected; and, (2) Locomotive speed. The Reset time primarily varies with speed, i.e., the higher the speed, the shorter the reset time. The maximum reset time is 46 seconds.

#### Reset Mode

During the Reset mode the function looks for an operator reset that can be either a manual reset or an event reset. A manual reset occurs when the operator operates the Whisker Reset switch causing it to change state. An event reset occurs when the operator causes one of the events listed in below to occur. On receiving a reset or if BCP > 25 psig, the Alerter immediately exits from the Reset mode. If no reset occurs before Reset mode expires, the Alerter enters the Alarm mode.



**Reset Inputs:**

1. Whisker Switch Reset
2. Bell Status Change
3. Horn Status Change
4. Combined Power Handle Movement (Throttle or Brake)
5. Reverser Movement
6. Independent Brake Bail-Off
7. Cab Signal/IITS Acknowledgement

**Alarm Mode**

In the Alarm mode the Alerter continues to look for an operator reset while generating an audio/visual alarm that is output through the AVB (Item 11, Fig. 9) in the Cab. On receiving a reset or if BCP is greater than 25 psi, the Alerter immediately exits from the Alarm mode and cancels all alarms. If no reset occurs before the Alarm mode expires, the Alerter enters the Penalty mode.

There are to be three means of warning the operator: (1) Pulsating audible alarm from AVB alarm box (max level about 90 db); (2) Pulsating visual alarm from AVB alarm box; and, (3) Flashing Time to Penalty display on IFD screens. If a proper reset is not received within the Reset time period, the alarm sequence will begin as shown below after the first reset.

The IFD Visual Alarm starts flashing, once per second, a yellow marker displaying the number of seconds remaining until Penalty Brake application. This marker appears on the IFD screen.

**NOTE: When the Alerter function first enters Active state from the Inactive state, reset time is held to 21 seconds. This is to provide protection roll off by a unit that is not properly manned.**

**TABLE 2. ALERTER RESET TIMES**

| Speed (MPH) | Penalty Brake Applied (Sec) |
|-------------|-----------------------------|
| 20          | 46                          |
| 40          | 41                          |
| 60          | 26                          |
| 80          | 19                          |
| 100         | 14                          |
| 110         | 12                          |

**Penalty Mode**

In the Penalty mode, the Alerter applies full service brake. The audible alarm is disabled. The Alerter then waits with the Alerter marker flashing until the minimum penalty time period has expired. At the end of the penalty period, the IFC turns off the visual alarm and exits from the Penalty mode. After exiting the penalty mode, the operator can remove the service brake application.

**NOTE: Brake Cylinder Pressure above 25 psi while in the Reset or Alarm mode will be treated like an event reset and preclude entering the Penalty mode since locomotive brakes are already applied.**

**Alerter Magnet Valve Test**

**CAUTION: Starting the Alerter Magnet Valve Test will apply a Full Service Brake application on the locomotive/train.**

Pressing key position F2 (Alerter Mag Valve) on screen 360 000 (Fig. 65) will display screen 362 000 (Fig. 56). This key is only active if the unit speed is equal or below 0.5 MPH. This key is not available on the Crew Display. Follow the directions presented in the Summary Message Area. Pressing key position F8 (Exit) will return the operator to screen 360 000 (Fig. 65).

**NOTE: If locomotive speed exceeds 0.5 MPH, the control system will stop the test, cancel the alarm, restore the magnet valve and return the operator to screen 360 000.**

**OVERSPEED**

The Locomotive IFC Overspeed Control is designed to promote safe train operation by initiating a penalty brake application if train speed reaches a pre-determined Penalty Speed limit. In addition the Engineer and crew are warned of any impending overspeed penalty when speed reaches a pre-determined Warning Speed limit. The IFD screen displays a flashing OVERSPEED alarm and is accompanied by a repetitive "beep-beep" from the AVB alarm box.

The flashing OVERSPEED light and audio alarm continues until train speed is reduced to below the Warning Speed or until train speed reaches Penalty Speed at which time the audio and visual alarm will turn on solid. After a delay time of one (1) second at or above Penalty Speed, IFC will trigger a penalty brake application. The delay is used to filter out any false penalty trips due to



wheel slip activity. Should speed reach a pre-determined maximum speed, the penalty is applied immediately. Speed is computed from the No 2 traction motor speed sensor.

Locomotive IFC Overspeed Control is active in a Non-Cab Signal territory. The Warning Speed is 82 mph and Penalty Speed is 83 mph. In IITS territory the Warning Speed is 92 mph and the Penalty Speed is 93 mph. Locomotive IFC Overspeed Control is not active in Cab Signal territory as this function is then performed by the cab signal equipment.

The locomotive has 3 separate modes of overspeed.

1. Cab Signal Overspeed; speed limits correspond to Signal Aspect.

2. IITS (IFC) Overspeed – 92 MPH
3. Locomotive Overspeed – 82 MPH.

Only one of the overspeed functions is in use at a time.

### Setup

- A. Cab signal operation: refer to Cab Signal section.
- B. IITS Operation: Cab Signal Circuit Breaker ON  
Cab Signal Transfer Switch: IITS
- C. Non-cab Signal Territory:

This applies only when the locomotive will not be in Cab Signal Territory at all during its operation.

Cab Signal Aspect Display: CUTOFF

Cab Signal Circuit Breaker – ON or OFF.

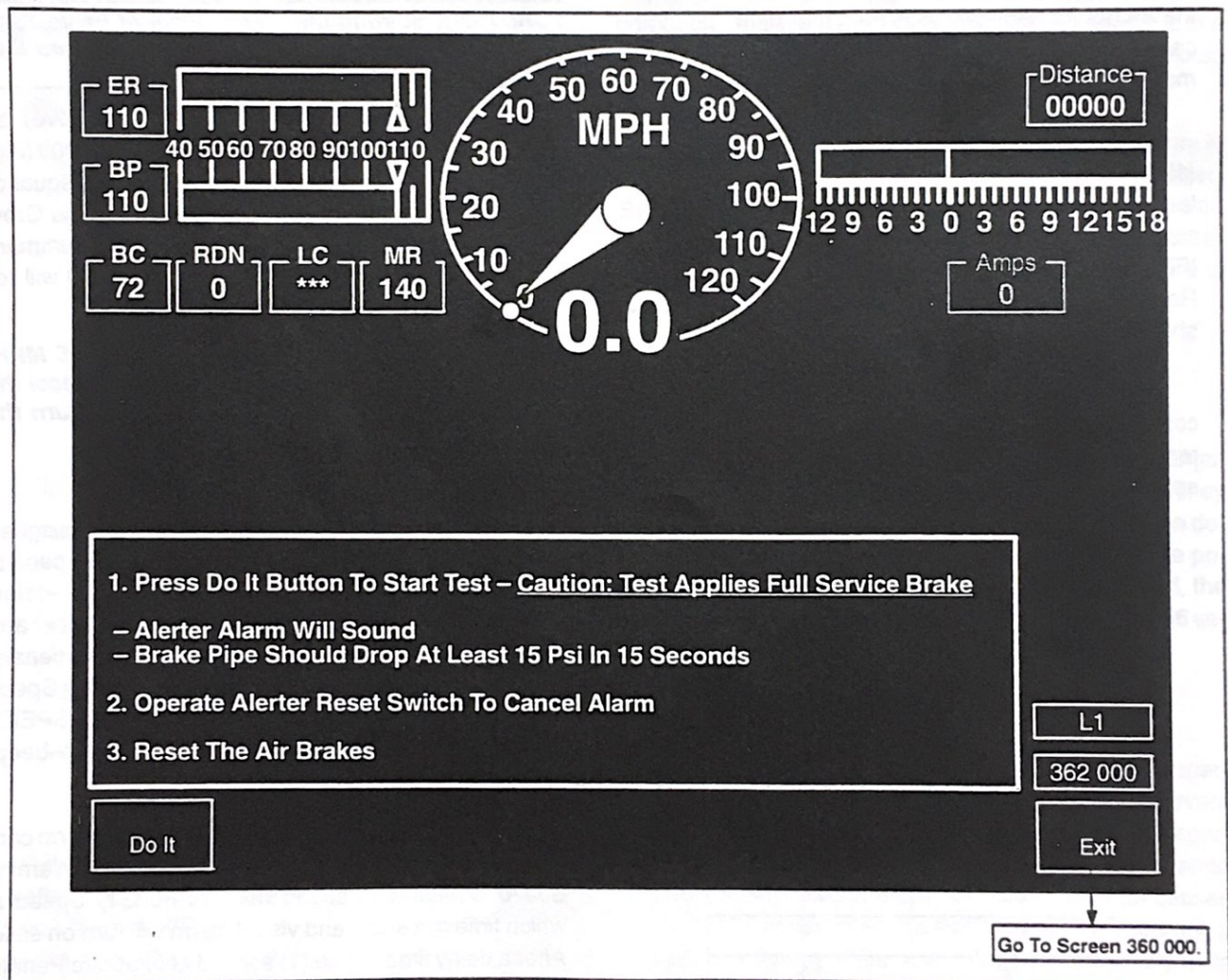


FIG. 56. ALERter MAGNET VALVE TEST SCREEN (362 000). E-42589.



## INTERMITTENT INDUCTIVE TRAIN STOP (IITS)

### General

The IITS system provides a means by which a passing locomotive can read the state of a wayside signal displaying an aspect other than CLEAR. The IITS can also read the state of a permanent location in IITS territory. An audio and visual warning is then provided on the Cab Signal Overspeed Display Panel (Fig. 55). Should the operator not acknowledge within 7 seconds, a penalty brake application with PCS will result.

### Operation

When the locomotive pickup bar, mounted on the engineer's side of the lead truck, passes over a wayside inductor which requires action by the engineer, the IITS electronics responds:

1. Sounds audio alarm on cab signal overspeed display panel.
2. "Overspeed" light on that panel lights.

The operator has seven (7) seconds to acknowledge which extinguishes the light and silences the alarm. Failure to act results in a penalty brake application.

While overspeed is not a function of the IITS system itself, operation of the system sets up the locomotive IFC overspeed system to operate at 92 MPH overspeed setting. Refer to that Overspeed section for details.

Holding down the Acknowledge button continuously for 15 seconds results in a penalty brake application.

### Penalty Brake Application

(See **Air Brake Equipment** section.)

Should IITS induce a penalty brake application, the following will result:

1. Red overspeed light on cab signal overspeed display panel will stay on.
2. Audio alarm will be silenced
3. Penalty brake application occurs with a service rate application and PCS
4. Brake pipe will drop to about 10 psig.

### Penalty Brake Recovery

(See **Air Brake Equipment** section.)

## Equipment

### Cab Signal Overspeed Display Panel

Same functions are shared with Cab Signal System; refer also to that section.

### Red Overspeed Indicator

Functions as Inductive Train Stop Warning – is illuminated when IITS needs an acknowledgment. It also remains lit if IITS induces a penalty.

### Audio Alarm

Sounds when IITS needs an acknowledgment.

### Territory Switch

Not used with IITS.

### Cab Signal Transfer Switch

The Cab Signal Transfer Switch (Item 40, Fig. 12) is used to determine whether the locomotive is operating in IITS (inductive train stop: Santa Fe) or Cab Signal mode.

### Cab Signal Cut-Out Switch

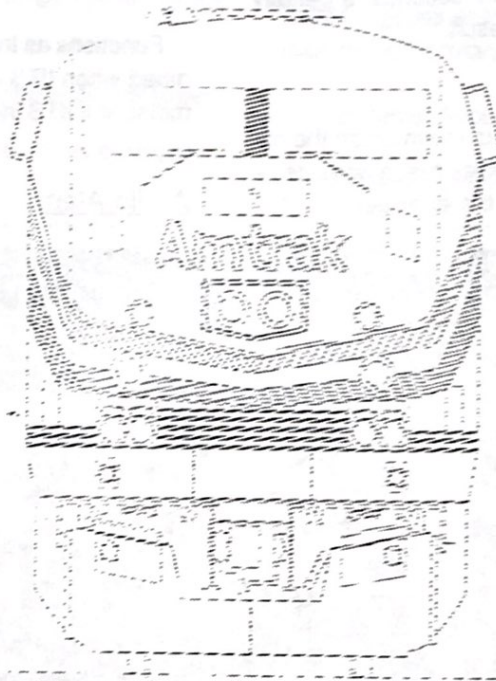
In cut-out position, this switch (Item 34, Fig. 12) prevents the IITS or Cab Signal System (whichever is selected by Cab Signal Transfer Switch) from inducing a penalty brake application. It does not disable IITS itself or IFC overspeed. When in cut-out, the CAB SIG CUT-OUT light is illuminated on the IFD screen.

### Setup

1. Cab Signal Circuit Breaker: ON.
2. Cab Signal Transfer Switch: IITS

This sets locomotive IFC overspeed at 92 MPH.







## HEAD END POWER

## INTRODUCTION

**NOTE:** Numbers in parentheses ( ) refer to items found on Figure 57 of this publication unless noted otherwise. See Railroad specific operating procedures for proper use of this panel.

This locomotive is equipped with a 480-volt, three-phase, 60-hertz power supply to provide hotel services to the trailing passenger cars. Head End Power (HEP) can be supplied from either a lead or trail unit or wayside as desired. If supplied from a trail unit, the HEP jumper cables between locomotives must be connected to supply loads such as HVAC and refrigerator in the lead unit.

## 480 VAC HEP Jumpers

In order for the HEP system to become energized, the 480 VAC HEP jumpers on the locomotive must either be connected to a passenger car, another locomotive or back into an unused receptacle on the locomotive the cable originated from so that the electrical circuit is "complete." This ensures that there will not be power at the free end of a jumper cable or empty receptacle unless cables are mated properly with receptacles. The exception to this is at the front of the lead unit. If the "Lead Isolate" switch (2) on the HEP control panel of the lead unit is set for "Lead," the front cables will not have power applied and need not be connected.

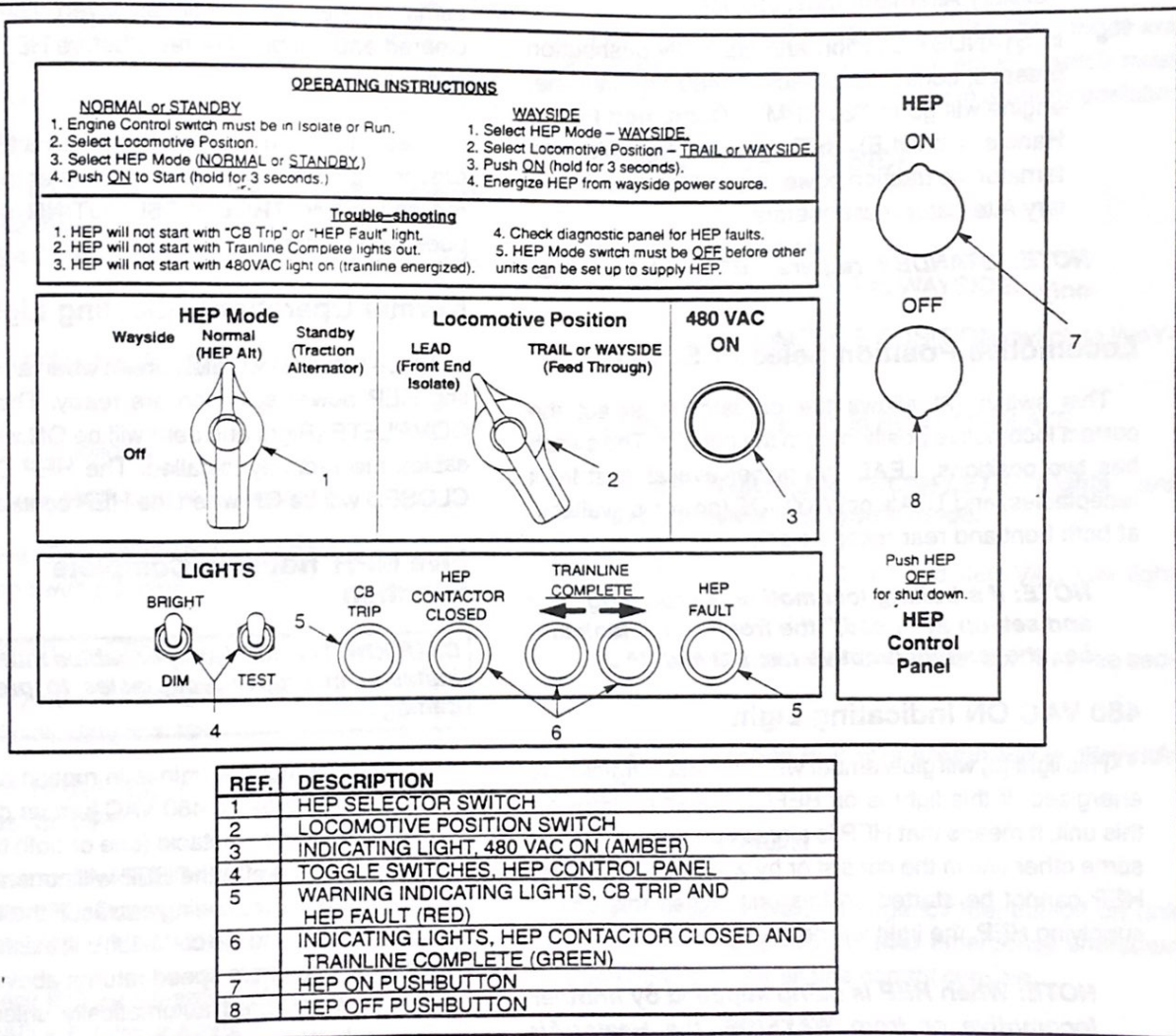


FIG. 57. HEAD END POWER CONTROL PANEL. E-41023A.



## CONTROL PANEL

### HEP Mode Selector Switch

This switch (1) allows the operator to select the correct operating mode. The switch has four positions: OFF, WAYSIDE, NORMAL (selects the HEP alternator) and STANDBY (selects the Traction Alternator).

With the Engine Control Switch (Item 19, Fig. 12) in RUN or ISOLATE, the HEP switch operates as follows:

- In OFF position, there is no trainline check or HEP operation available.
- In NORMAL position and HEP ON pushbutton pressed (7), control will check for 480V on trainline, engine will go to 900 RPM, HEP Alternator and traction motor operation are allowed, and Auxiliary Alternator must operate.
- In STANDBY position and HEP ON pushbutton pressed, control will check for 480V on trainline, engine will go to 720 RPM (if Combined Power Handle is in IDLE), HEP operation from Main Alternator, no traction power is available, and Auxiliary Alternator must operate.

**NOTE:** STANDBY requires EC switch in Run only.

### Locomotive Position Selector Switch

This switch (2) allows the operator to select the correct locomotive positioning in the consist. The switch has two positions: LEAD (no power available at front receptacles) and TRAIL or WAYSIDE (power is available at both front and rear receptacles).

**NOTE:** If a trailing locomotive is providing HEP and set-up as "Lead," the front end is isolated, i.e., the lead locomotive has NO 480 VAC.

### 480 VAC ON Indicating Light

This light (3) will glow amber when the 480V trainline is energized. If this light is on BEFORE starting HEP on this unit, it means that HEP is already being supplied by some other unit in the consist or by wayside. Therefore, HEP cannot be started on this unit. When this unit is supplying HEP, the light will be on.

**NOTE:** When HEP is being supplied by another locomotive or from WAYSIDE, the Heater/Air Conditioner, the 120 VAC system (including

maintenance lighting and 12 V battery charger) and the Redundant Battery Charger systems are operable.

### Light Toggle Switches

These switches (4) control the brightness and enable the operator to test the HEP panel lights.

### CB TRIP and HEP FAULT Indicating Lights

The HEP circuit breaker (HECB Item 15, Fig. 13), located behind the CA1 compartment access door on the left side of the operators cab, will protect the HEP system from short circuits. If a system fault occurs which causes the circuit breaker to trip, an indicating light (5) will be illuminated on the HEP control panel and an IFD summary message will be displayed. The fault must be cleared and the breaker reset before HEP can be reapplied.

These lights (5) will glow red when a situation exists preventing HEP power selection. Refer to IFD Function messages and **TROUBLESHOOTING** section of this publication if either light is ON.

### Normal Operation Indicating Lights

These lights (6) will glow green when all circuits enabling HEP power selection are ready. The TRAINLINE COMPLETE (Right and Left) will be ON when the 480V cables are properly installed. The HEP CONTACTOR CLOSED will be ON when the HEP contactor is closed.

### Five MPH Trainline Complete Function

**CAUTION.** The 480V jumper cables must always be installed in proper receptacles to prevent cable damage.

In the event that the train is in motion above 5 MPH and one or more of the 480 VAC jumper cables loses connection with a receptacle (one or both trainline complete lights will be off), the HEP will continue to be provided through the remaining cables. If the train slows to less than 5 MPH and the condition still exists, HEP will be shut down. Once train speed returns above 5 MPH, the HEP will be restarted automatically unless the "HEP OFF" pushbutton on the HEP control panel is pushed or the train speed is below 5 MPH for 20 minutes.



## HEP ON And OFF Pushbuttons

The ON pushbutton (7) starts HEP power as long as CB TRIP, HEP FAULT and 480 VAC ON lights are OFF, the TRAINLINE Right and Left Lights are ON and HEP MODE switch is in NORMAL or STANDBY position. The engine will change RPM to 900 (Normal Mode) or 720 (Standby Mode). Upon achieving the correct engine RPM, the HEP or Traction Alternator will supply the 480V. The OFF pushbutton (8) disables the HEP circuit and returns the engine to the RPM requested by the **Combined Power** handle.

Because the engine speed is limited to 900 RPM when operating in HEP "NORMAL" mode (vs. 1050 RPM when not in normal mode) the maximum engine gross horsepower is limited to 3650 for combined use of HEP, Engine Auxiliary Loads and Traction (vs 4250 gross horsepower if not in normal mode). After HEP and engine aux. loads are satisfied, the remaining horsepower is available for traction.

**NOTE:** When the locomotive is providing HEP, the IFD message line will provide a **SUMMARY MESSAGE** to indicate the HEP operating conditions.

## HEP STARTUP NORMAL MODE

Start HEP as follows:

1. Position HEP MODE to NORMAL.
2. Move LOCOMOTIVE POSITION switch to correspond with position of locomotive in consist.
3. Position EC switch to RUN or ISOLATE.
4. Verify both TRAINLINE COMPLETE Lights are ON indicating the 480V cables are installed.
5. HEP FAULT, CB TRIP and 480 VAC ON light **must be OFF**.
6. Press and hold HEP ON pushbutton for three seconds. IFD Summary Message indicates: "HEP START IN PROCESS."
7. Check IFD for Summary Message: "HEP IS ON: LOAD = x Volts; x Amps."
8. Engine will now operate at 900 RPM.

## HEP STARTUP STANDBY MODE

When a train will be sitting in a station for an extended period of time or if there is a fault condition on the "NORMAL" HEP system, HEP can be supplied using the "STANDBY" mode of operation. In this mode power is supplied by the traction alternator instead of the HEP alternator.

"STANDBY" mode has the advantage of operating at a lower engine speed (720 vs 900 RPM). This reduces fuel consumption and lowers noise level. The disadvantage to operating in this mode is that there is less HEP available (approximately 650 vs 800 KW). Also, traction and dynamic brake are disabled.

HEP Startup and Shutdown for "STANDBY" mode are the same as "NORMAL" mode except EC switch must be in "RUN" position and HEP Mode in Standby position.

## HEP STARTUP WAYSIDE MODE

Start HEP as follows:

1. Position HEP MODE to WAYSIDE.
2. Move LOCOMOTIVE POSITION switch to WAYSIDE.
3. Position EC switch to RUN or ISOLATE.

**NOTE:** TRAINLINE COMPLETE Lights are extinguished in Wayside mode.

5. HEP FAULT, CB TRIP and 480 VAC ON light **must be OFF**.
6. Press and hold HEP ON pushbutton for three seconds.

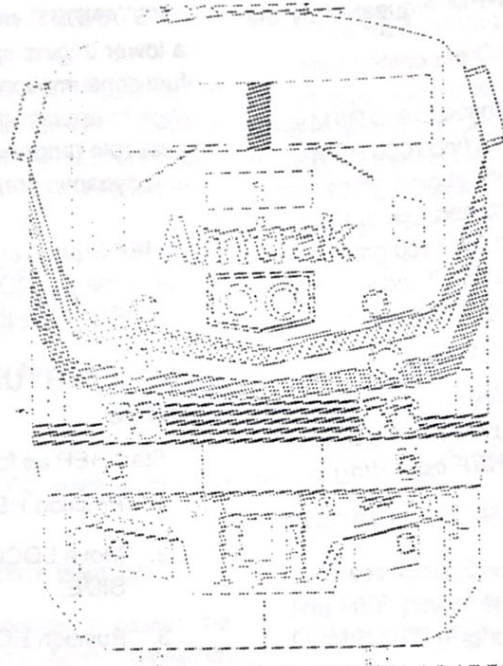
**NOTE:** Traction Power is prohibited in Wayside mode.

## HEP SHUTDOWN

In Emergency press emergency fuel cut-off on unit supplying HEP or press the M/U emergency shutdown push button on the engine control console.

Press HEP OFF button (8) on HEP control panel for shut down.







## CRUISE CONTROL

### INTRODUCTION

The Cruise Control (Fig. 58) function will attempt to maintain locomotive speed at a selected speed. This function allows the operator to turn the function ON and OFF over the full range of locomotive speed. The Cruise Control function is a *power control function* only; that means *braking* is not provided as part of the function.

If the locomotive is operating on a steep grade that requires more horse power than is set by the **Combined Power** handle, the locomotive speed will reduce until the operator increases the **Combined Power** handle position. For example, if manual operation requires Notch 6 and the operator selected Notch 5 in Cruise, train speed would not be maintained. If operator selected Notch 6, 7 or 8 in Cruise, speed would be maintained.

Also, if the locomotive is on a steep downgrade, the control can only decrease traction power to zero. If reducing traction power to zero is still insufficient to maintain speed – **the operator MUST apply the brakes.** Cruise Control does NOT apply the brakes!

**NOTE: These keys are NOT available on the Crew Member's Display.**

### OPERATION

Pressing key position F2, **Cruise Control**, on the Main Operation Screen (screen 000 000, see Fig. 61) will display screen 200 000. The active keys and a brief description of operation are as follows:

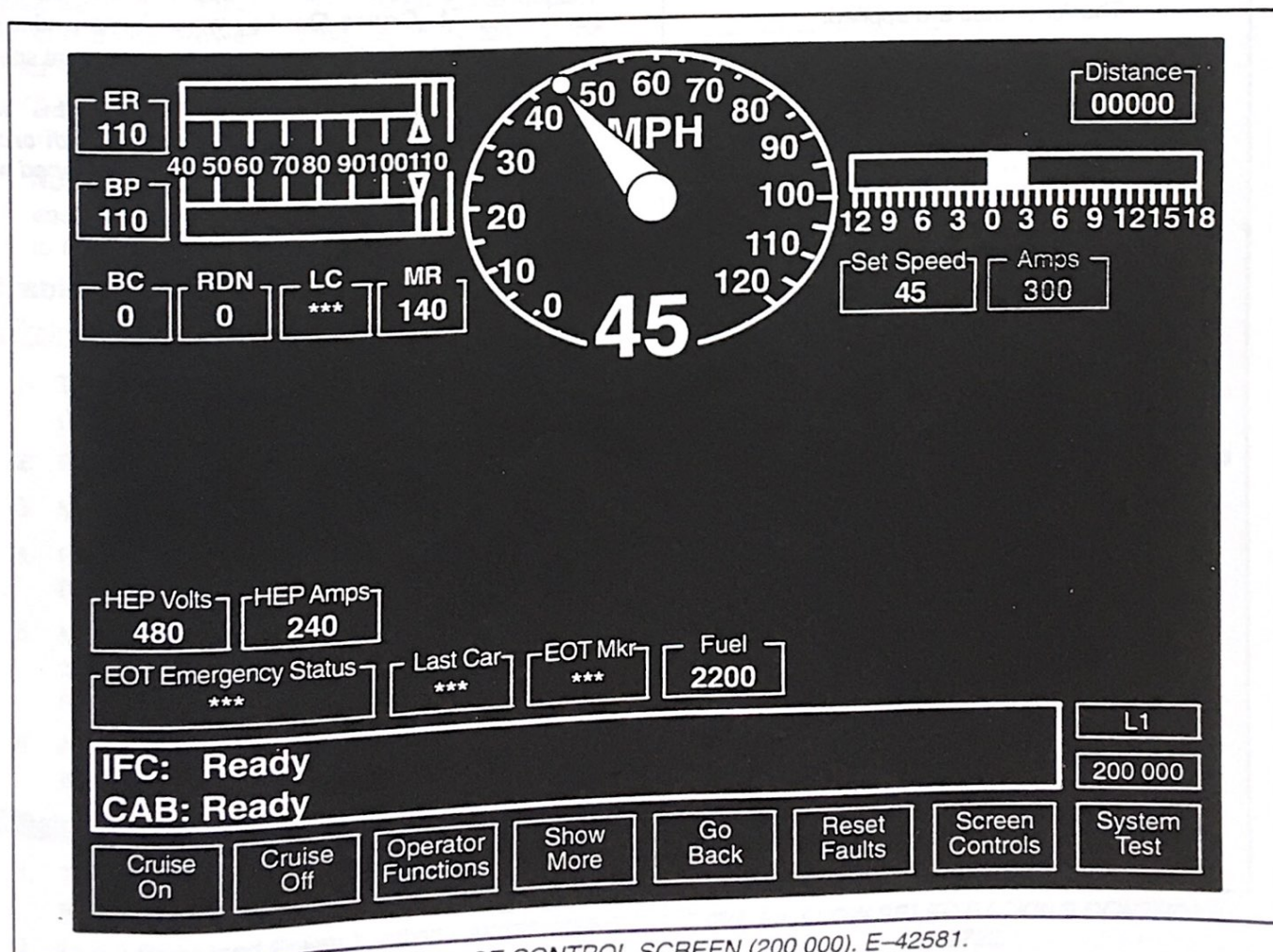


FIG. 58. CRUISE CONTROL SCREEN (200 000). E-42581.

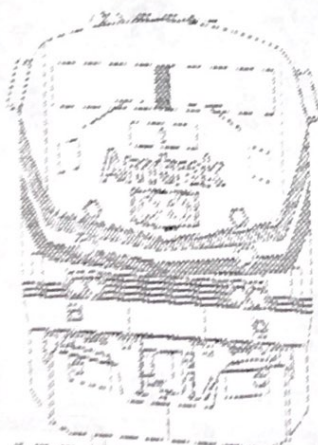


1. Pressing key position F1 (**Cruise On**) will turn the Cruise Function ON and set the speed to the actual locomotive speed. The IFD screen will display the cruise speed in the SET SPEED block. The Cruise Function is only available when all of the following conditions are met:
    - The locomotive is set-up for LEAD operation.
    - The locomotive is in Forward and Motoring.
    - The brakes are not applied.
    - The locomotive is not in IDLE.
    - The locomotive is not in Slow Speed Backing.
  2. Press key position F2 (**Cruise Off**) will cancel the Cruise Control Function. Cruise Control may also be cancelled by any of the following:
    - The locomotive set-up is changed to TRAIL.
    - The **Combined Power** handle is moved to IDLE or a BRAKE position.
    - The Air Brakes are applied.
  3. To increase cruise set speed:
    - Turn OFF Cruise by pressing F2 (**Cruise Off**) key.
    - Increase speed as desired.
  - Press F1 (**Cruise On**) key which turns Cruise ON and adjusts new set speed to current speed.
  4. To decrease cruise speed:
 

Cruise set speed can be reduced by either of two ways.

    - Turn OFF Cruise by pressing F2 (**Cruise Off**) key.
    - Decrease speed as desired.
    - Press F1 (**Cruise On**) key which turns Cruise ON and adjusts new set speed to current speed.
- OR
- Reduce **Combined Power** handle enough that the set speed cannot be maintained.
  - When desired lower speed is reached, Press F1 (**Cruise On**) key which turns Cruise ON and adjusts new set speed to current speed.

**NOTE:** *Cruise Control only operates with trailing units if units are equipped with cruise control feature. Trailing units not equipped with cruise control go to IDLE.*





## SLOW SPEED BACKING

### INTRODUCTION

Slow Speed Backing Control is a feature used to control locomotives when backing a train. It provides the engineer with a quick responding, fine control. Slow speed control is not integrated with IFC.

This function is available only in reverse with **Combined Power** handle in notches 1–8. Cruise control cannot be activated in slow speed control.

### OPERATION

An indicating light (Fig. 59, Item 1) will turn ON notifying the engineer that the system is active.

The control knob (3) adjusts the amount of motoring excitation applied to the traction motors during Slow Speed Backing operation from 0–100%. For example, if the **Combined Power** handle is in Notch 3, the excitation can be adjusted from zero to the maximum Notch 3 current. The maximum available motor current is always determined by the selected throttle notch.

**NOTE:** In MU operation, if a trailing unit is not equipped with Cruise Control, that unit will go to IDLE.

#### Enable Slow Speed Backing

##### If Train is Standing

1. Turn slow speed excitation control knob to **MIN** (Fig. 59, Item 3).
2. Place Reverser in reverse.
3. Move **Combined Power** handle to Notch 1.
4. Press (engage) slow speed backing push button (Fig. 59, Item 2).
5. Move **Combined Power** handle to position required to provide sufficient amperage for movement.
6. Adjust slow speed backing excitation control knob to provide desired excitation.

##### If Train is Moving Backward

1. Turn slow speed backing excitation control knob to **MAX** (Fig. 59, Item 3).
2. Leave **Combined Power** handle in current position (except IDLE).

3. Press (engage) slow speed backing push button (Fig. 59, Item 2).
4. Adjust slow speed backing excitation control knob to provide desired excitation.

**NOTE:** Combined Power handle may be advanced to increase available excitation **"ONLY"** after system is engaged as required in enabling instructions for Moving.

**NOTE:** Brake applications will **NOT** negate slow speed braking system operation.

#### Disable Slow Speed Backing

To deactivate Slow Speed Backing, move the **Combined Power** handle to IDLE. This function is deactivated when going to IDLE so a vacating crew cannot leave the locomotive in the backing mode.

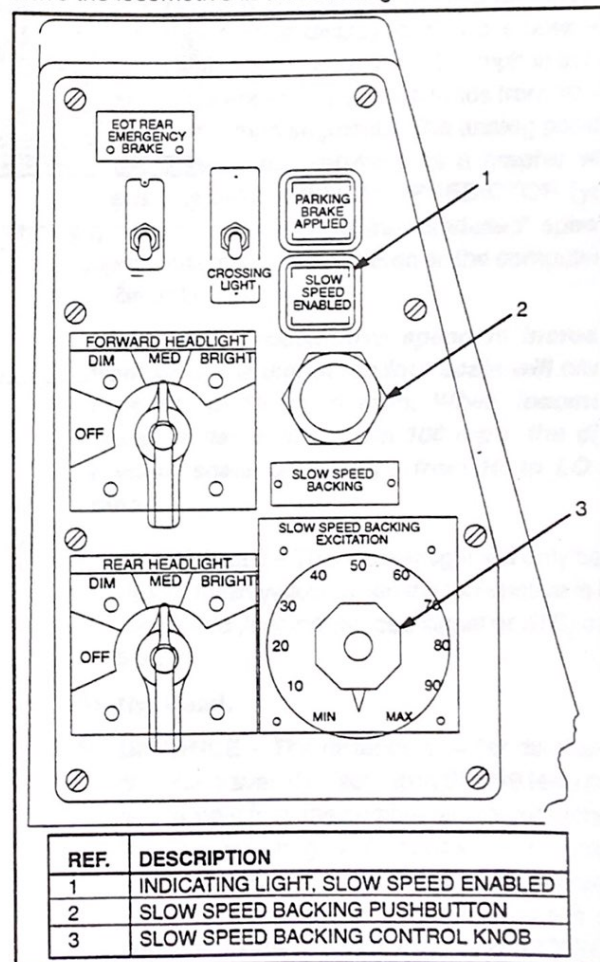
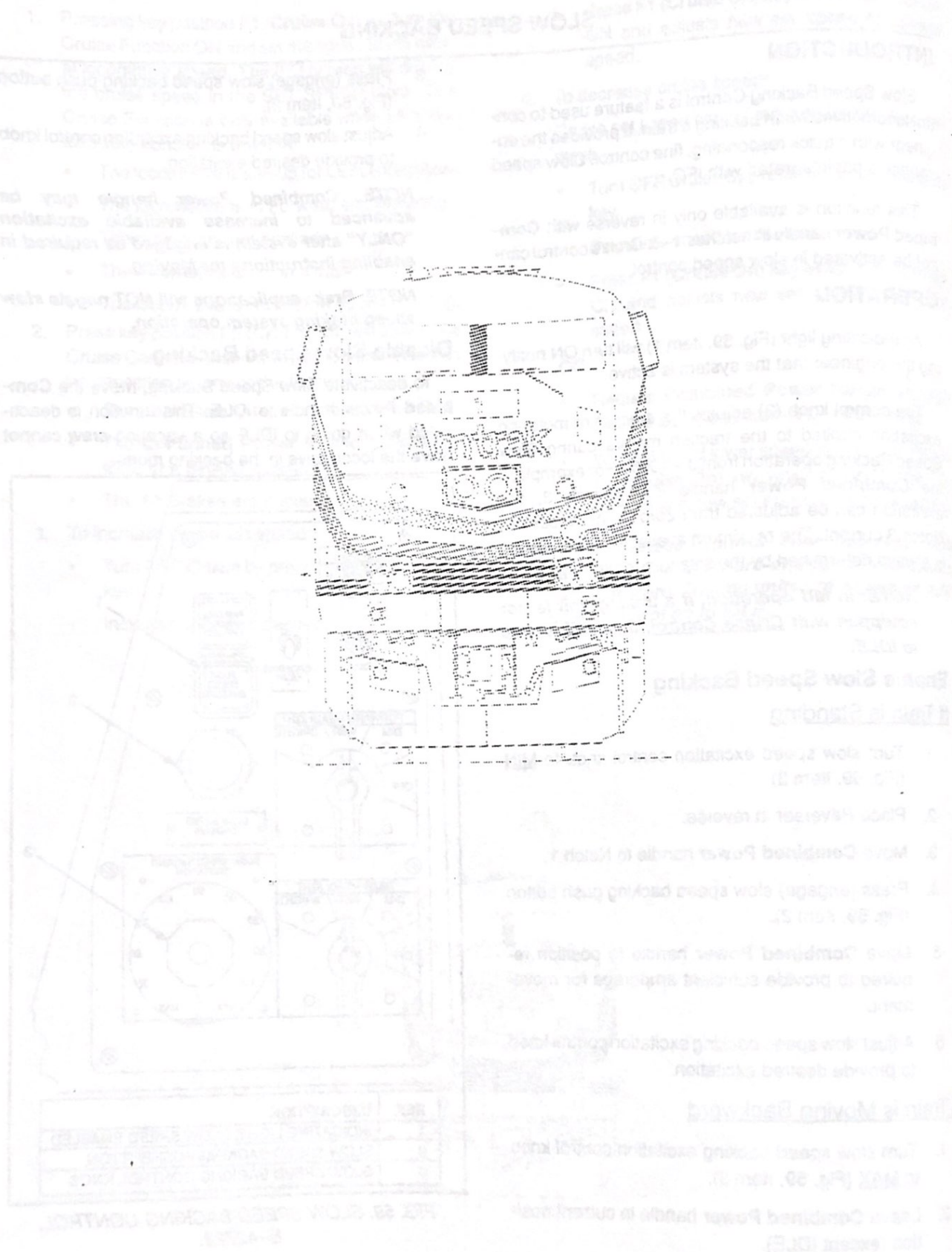


FIG. 59. SLOW SPEED BACKING CONTROL.  
E-42722.







## INTEGRATED FUNCTION CONTROL

### INTRODUCTION

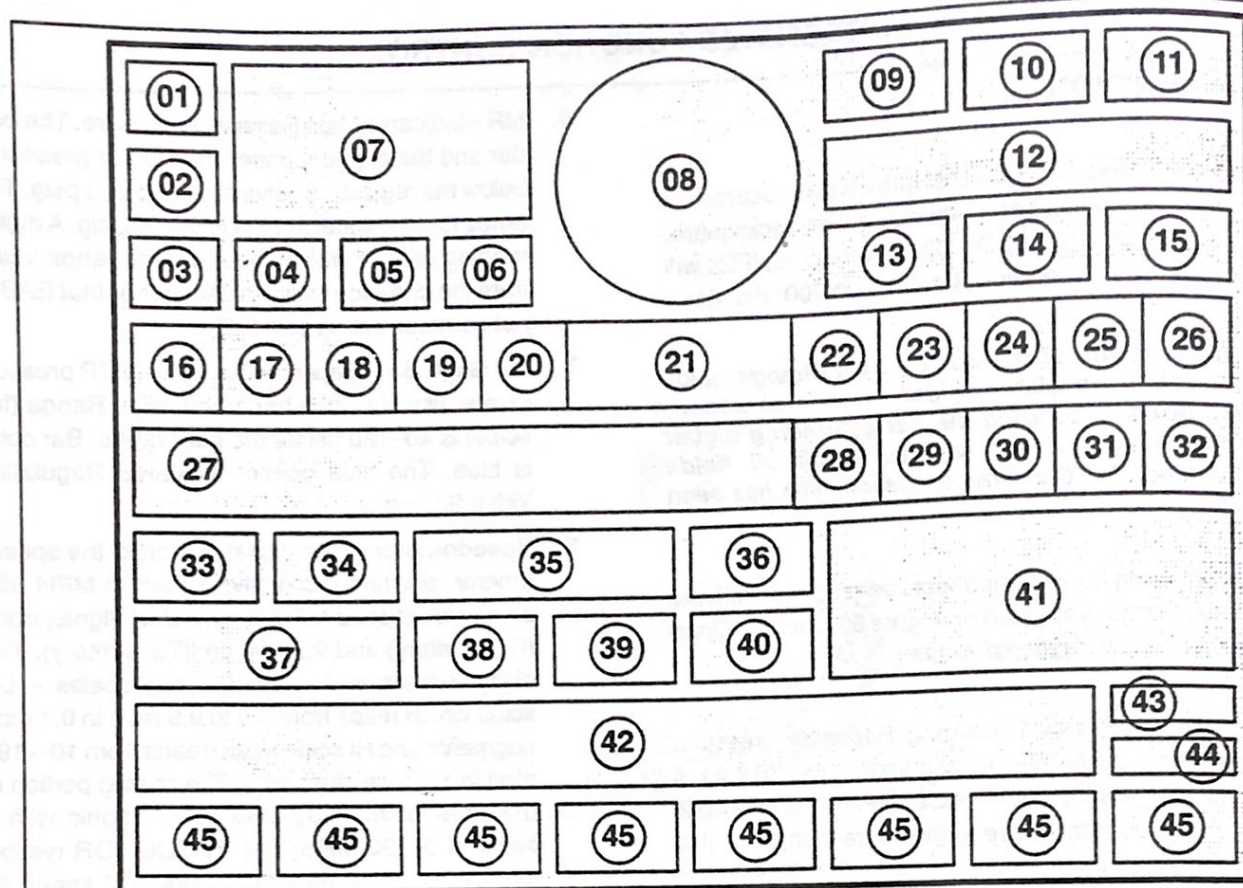
The Integrated Function Displays (IFDs), located on the control consoles, are ten-inch diagonal, backlit, liquid crystal displays (LCD). On Power Up, all IFDs will display the Main Operation Screen (000 000, Fig. 61).

**NOTE:** *If any of the analog bars change color indicating an alarm or out-of-limit condition, the box surrounding the corresponding digital indication will turn yellow. When all fields contain "\*\*\*\*," the communications link has been lost.*

The following list of components corresponds with the numbered items presented on Figure 60, *Sample Operation Screen Informational Areas*:

1. **ER** – indicates Equalizing Reservoir pressure. The range for this digital marker is 0–200 psig. A digital reading of "\*\*\*\*" indicates an out-of-range value from the corresponding transducer or that EAB is not communicating with IFC.
2. **BP** – indicates locomotive Brake–Pipe pressure. The range for this digital marker is 0–200 psig. A digital reading of "\*\*\*\*" indicates an out-of-range value from the corresponding transducer or that EAB is not communicating with IFC.
3. **BC** – indicates Brake Cylinder pressure. The range for this digital marker is 0–200 psig. A digital reading of "\*\*\*\*" indicates an out-of-range value from the corresponding transducer or that EAB is not communicating with IFC.
4. **RDN** – indicates reduction in the Brake Pipe pressure below setting. The block and number will turn yellow at pressures greater than 140 psig. A digital reading of "\*\*\*\*" indicates an out-of-range value from the corresponding transducer or that EAB is not communicating with IFC.
5. **LC** – indicates brake pipe pressure for the last car if the End–Of–Train (EOT) device is installed. The border and digital number turn red at pressures below 45 psi. If "EOT COMM" alarm is active, or if communication between IFC and EOT is broken, or if EOT is turned OFF, the number will read "\*\*\*\*."
6. **MR** – indicates Main Reservoir pressure. The border and the digital number turn red at pressures below the regulating valve pressure +15 psig. The range for this digital marker is 0–200 psig. A digital reading of "\*\*\*\*" indicates an out-of-range value from the corresponding transducer or that EAB is not communicating with IFC.
7. **Air Gage Bar Graphs** – The ER and BP pressures are also shown in bar graph form. Range (full scale) is 40–120 psi for the bar graphs. Bar color is blue. The blue pointer indicates Regulating Valve Setting.
8. **Speedometer** – The digital portion of the speedometer registers locomotive speed in MPH with an alarm set at 82 MPH (if non–Cab Signal, non–IITS territory) and 92 mph (in IITS territory). The digital portion is displayed in two scales – LO scale which reads from 0.0 to 9.9 mph in 0.1 mph segments and HI scale which reads from 10–199 mph in 1.0 mph segments. The analog portion of the speedometer registers as a graphic with a scale of 0–120 MPH. The PREDICTOR (yellow circle in rim) indicates the "predicted" speed 60 seconds from present based on the computed acceleration rate.  
  
**NOTE:** *When locomotive speed is increasing from zero, the digital readout scale will change from LO to HI at 10 mph. When locomotive speed is decreasing from 100 mph, the digital readout scale will change from HI to LO at 8 mph.*
9. **OVERSPEED** – This marker light will only be displayed (flash yellow) when the locomotive is in an overspeed (locomotive, cab signal or IITS) condition.
10. **Not Used.**
11. **DISTANCE** – The distance counter displays the distance traveled in feet (up to 99,999 feet) based on the input from the number two motor tachometer. The counting is bi-directional (counts up when moving forward; back when in reverse) except when passing through zero where it starts counting up again. Use the soft keys (COUNT UP, COUNT DOWN, ZERO COUNTER) to control counter operation from Screen 310 000.





| REF. | DESCRIPTION                                    | REF. | DESCRIPTION                                       |
|------|--|------|---|
| 1    | EQUALIZING RESERVOIR PRESSURE INDICATOR (ER)   | 23   | CAB SIGNAL TEST ALARM (CAB SIG TEST)              |
| 2    | BRAKE PIPE PRESSURE INDICATOR (BP)             | 24   | ALERter CUTOUT ALARM (ALERter CUT OUT)            |
| 3    | BRAKE CYLINDER PRESSURE INDICATOR (BC)         | 25   | OVERSPEED SYSTEM CUTOUT ALARM (OVR SPD CUT OUT)   |
| 4    | BRAKE PIPE REDUCTION INDICATOR (RDN)           | 26   | CAB SIGNAL SYSTEM CUTOUT ALARM (CAB SIG CUT OUT)  |
| 5    | LAST CAR PRESSURE INDICATOR (LC)               | 27   | AIR BRAKE MESSAGE WINDOW                          |
| 6    | MAIN RESERVOIR PRESSURE INDICATOR (MR)         | 28   | EOT COMMUNICATION LOSS ALARM (EOT COMM)           |
| 7    | AIR PRESSURE (ER AND BP) BAR GRAPH             | 29   | END OF TRAIN PRESSURE ALARM (EOT LOW AIR)         |
| 8    | LOCOMOTIVE SPEEDOMETER (GRAPHIC AND DIGITAL)   | 30   | END OF TRAIN VALVE ALARM (EOT VALVE)              |
| 9    | OVERSPEED ALARM (OVER SPEED)                   | 31   | END OF TRAIN BATTERY ALARM (EOT BATT)             |
| 10   | NOT USED                                       | 32   | NOT USED  |
| 11   | DISTANCE COUNTER DISPLAY                       | 33   | HEAD END POWER SUPPLIED VOLTAGE (HEP VOLTS)       |
| 12   | LOAD METER BAR GRAPH                           | 34   | HEAD END POWER SUPPLIED CURRENT (HEP AMPS)        |
| 13   | SET SPEED INDICATOR (SET SPEED)                | 35   | NOT USED  |
| 14   | LOAD METER (AMPS)                              | 36   | NOT USED  |
| 15   | NOT USED                                       | 37   | END OF TRAIN SYSTEM STATUS (EOT EMERGENCY STATUS) |
| 16   | WHEELSLIP/LOCKED AXLE ALARM (SLIP/AXLE WARN)   | 38   | END OF TRAIN MOTION MARKER (LAST CAR)             |
| 17   | PCS OPEN ALARM (PCS OPEN)                      | 39   | END OF TRAIN LANTERN MARKER STATUS (EOT MKR)      |
| 18   | SAND ALARM (SAND)                              | 40   | FUEL LEVEL INDICATOR (FUEL)                       |
| 19   | DYNAMIC BRAKE ALARM (DYN BRAKE)                | 41   | NOT USED  |
| 20   | PENALTY BRAKE ALARM (PENALTY BRAKE)            | 42   | OPERATOR MESSAGE WINDOW                           |
| 21   | ALERter ALARM COUNTDOWN (ALERter)              | 43   | OPERATION SCREEN LEVEL INDICATOR                  |
| 22   | CAB SIGNAL SUPPRESSED ALARM (CAB SIGNAL SUPPR) | 44   | OPERATION SCREEN NUMBER                           |
|      |  | 45   | MENU SOFT KEYS*                                   |

\*SEE APPROPRIATE SECTIONS OF THIS MANUAL FOR KEY DESIGNATIONS AND LABELS.

FIG. 60. SAMPLE OPERATION SCREEN INFORMATIONAL AREAS. E-42566.



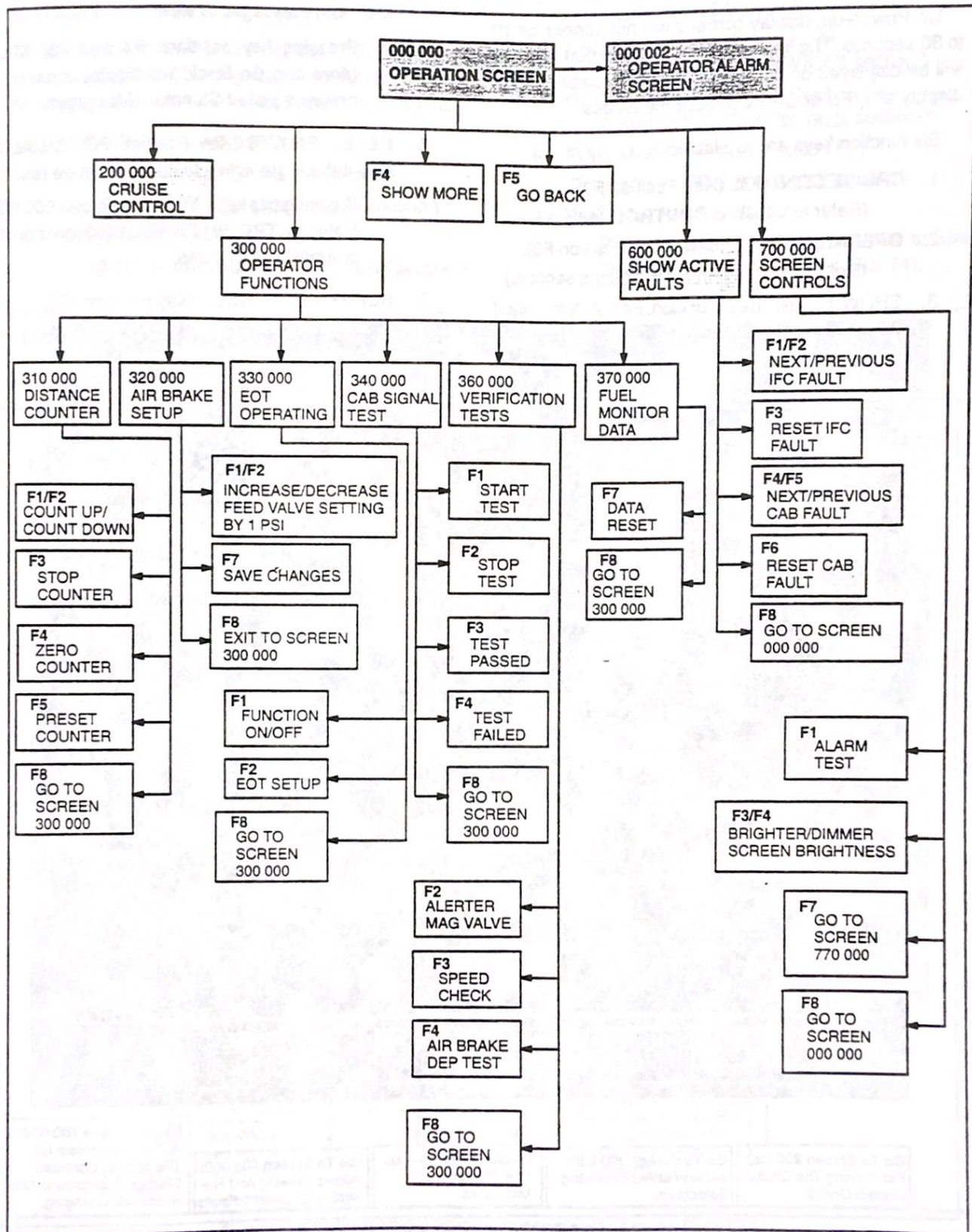
12. **Load Meter Bar Graph** – This graph shows the average braking or motoring current (Amps) from all cut-in traction motors. In **Motoring**, the bar (from 0 to 1800 Amps) is green. In **Braking**, the bar (from 0 to 1200 Amps) is yellow. This bar also turns yellow at Dynamic Brake setup. This bar will turn red at high current (1400 Amps).
- NOTE: The Load Meter Bar Graph should show "0" during Self Load.**
13. **SET SPEED** – This status marker indicates the operator selected Set Speed for the Cruise Control system.
14. **AMPS** – This status marker indicates digitally what the **Load Meter Bar Graph** (12), located directly above, is displaying. The range is from 0 to 1399 Amps with motoring in green and 1400 to 1800 Amps with motoring in red. The range is from 0 to 1200 Amps with braking in yellow.
15. **Not Used.**
16. **SLIP/AXLE WARN** – This white marker light indicates that the wheels on some locomotives in the consist are slipping or sliding. This is a trainlined indication. Refer to **TROUBLESHOOTING** section found at the end of this manual for more information.
17. **PCS OPEN** – This white marker light indicates a Penalty or Emergency air brake application has occurred. Power has been eliminated. Engine speed remains at IDLE. Refer to **TROUBLESHOOTING** section found at the end of this manual for more information and to **AIR BRAKE EQUIPMENT** section.
18. **SAND** – This white marker light indicates that sanding is taking place either manually or automatically as a result of wheelslip. During a wheelslip, sanding and the SAND light will automatically turn on, then off.
19. **DYN BRAKE** – This flashing yellow marker light indicates that a locomotive in the consist is experiencing excessive dynamic braking current. Reduce the **Braking** Handle position until this light goes out.
20. **PENALTY BRAKE** – This flashing yellow marker light indicates that the locomotive is in a penalty brake situation. Refer to **TROUBLESHOOTING** section found at the end of this manual for more information and to **AIR BRAKE EQUIPMENT** section.
21. **ALERter** – This area counts down to an Alerter Penalty Brake. In Penalty Brake situations, the square will flash red and the alarm will sound until reset occurs or a penalty brake application occurs.
- NOTE: The Alerter system will flash yellow and count down from 25 if proper operator response has not been detected. See Operating Procedures Section of this manual for further information.**
22. **CAB SIGNAL SUPPR** – This alarm light indicates that the cab signal equipment recognizes that the Automatic Brake handle is in SUPPRESSION and cab signal Overspeed Penalties will be suppressed.
23. **CAB SIGNAL TEST** – This alarm light indicates that the cab signal equipment recognized the request to enter the Self Test Mode and the test is in progress.
24. **ALERter CUT OUT** – This alarm light indicates that the IFC has determined that the alerter cut-out switch has been moved to the cut out position and Alerter Penalties will not occur.
25. **OVR SPD CUT OUT** – This alarm light indicates that the IFC has determined that the Overspeed Cut-out switch has been moved to the cut out position and Overspeed Penalties will not occur.
- NOTE: The Overspeed Cut-out switch has no effect on Cab Signal Overspeed Penalties.**
26. **CAB SIG CUT OUT** – This alarm light indicates that the cab signal cut-out switch has been moved to the cut-out position. Cab Signal/IITS penalty brake applications will not occur.
27. **Air Brake Message Window** – The yellow worded messages (possible two lines) inform the operator of the Electronic Air Brake system status. See **AIR BRAKE EQUIPMENT** section of this document.
28. **EOT COMM** – This marker light indicates component problems with the End of Train (EOT) device. EOT COMM will light yellow when communication with EOT transmitter is broken. The computer will also order the Audio Visual Alarm Box (AVB) to beep. Value for LC (5) will be \*\*\* if EOT COMM alarm is active. See Railroad Regulations for appropriate action.



29. **EOT LOW AIR** – This marker light indicates that the last car brake pipe pressure has fallen below 45 psig. *See Railroad Regulations for appropriate action.*
30. **EOT VALVE** – This marker light indicates that the the EOT valve is defective. *See Railroad Regulations for appropriate action.*
31. **EOT BATT** – This marker light indicates component problems with the End of Train (EOT) device. EOT BATT will light yellow when the EOT battery is weak and light red when dead. *See Railroad Regulations for appropriate action.*
32. **Not Used.**
33. **HEP VOLTS** – This status marker indicates the voltage being supplied by the Head End Power system only on the unit supplying HEP. It does not display HEP volts from a trailing unit or wayside.
34. **HEP AMPS** – This status marker indicates the amount of current (amps) being supplied by the Head End Power system only on the unit supplying HEP. It does not display HEP amps from a trailing unit or wayside.
35. **Not Used.**
36. **Not Used.**
37. **EOT Emergency Status** – This message window indicates the Two-Way EOT status. Indications are: "Enabled," "Disabled," "One Way" or "\*\*\*\*." The "\*\*\*\*" indicates an out-of-range or unknown condition while the yellow "Disabled" indicates an alarm (or operator take note) condition.
38. **LAST CAR** – This status marker indicates movement status of the EOT Device. Indications are: "Moving" or "Stop."
39. **EOT MKR** – This white status marker indicates the EOT Lantern Marker status. Indications are "ON" or "OFF." When in "OFF," the status marker is yellow. A "\*\*\*\*" will be displayed for an out-of-range, unknown value, loss of communication or not installed EOT.
40. **FUEL** – This white status marker indicates how much fuel is remaining in the fuel tank. The range is 0 to 9999 gallons. When the remaining fuel drops below 500 gallons, the status marker will turn yellow. The right front and left rear sections of the four-compartment fuel tank have fuel level sensors. Total fuel is calculated by adding the readings from the two sensors then multiplying by two. The indication displayed is an approximation of total fuel.
41. **Not Used.**
42. **Operator Message Window** – This area will display Summary and Fault Messages from the IFC system. Usually a white status indicator, this area will turn yellow whenever there is a new message or active alarm.
43. **Operation Screen Level Indicator** – This white status marker indicates what level of operation the displayed screen permits.
44. **Operator Screen Number** – This white status marker indicates what Operation Screen is being displayed. The number is used for operator assistance while operating the IFDs and is listed in this manual as reference points.
45. **Menu Soft Keys** – Below the Operator Message Window is a keypad with eight keys. Menu information only appears over active keys. See appropriate sections of this manual for key designations and labels.



TABLE 3. IFD SCREEN FLOW CHART.





## MAIN OPERATION SCREEN

On Power-up, display screens will not appear for 10 to 30 seconds. The Top Level Screen (000 000, Fig. 61) will be displayed on all IFDs and the message line will display any IFC or CAB Operator messages.

Six function keys are available:

1. CRUISE CONTROL (Key Position F2).  
(Refer to **CRUISE CONTROL** section.)
2. OPERATOR FUNCTIONS (Key Position F3).  
(Refer to **IFC, Operator Functions** section.)
3. SHOW MORE (Key Position F4). Active only if there are more messages to view.

4. GO BACK (Key Position F5). Active only if there are more messages to view.

Pressing key positions F4 and F5, **Show More** and **Go Back**, will display the next or previous pair of Summary Messages.

5. RESET FAULTS (Key Position F6). Displayed only if there are active faults that can be reset.

Pressing this key will display screen 600 000. Refer to **TROUBLESHOOTING** section for operating procedures.

6. SCREEN CONTROLS (Key Position F7).  
(Refer to **IFC, Screen Controls** section.)

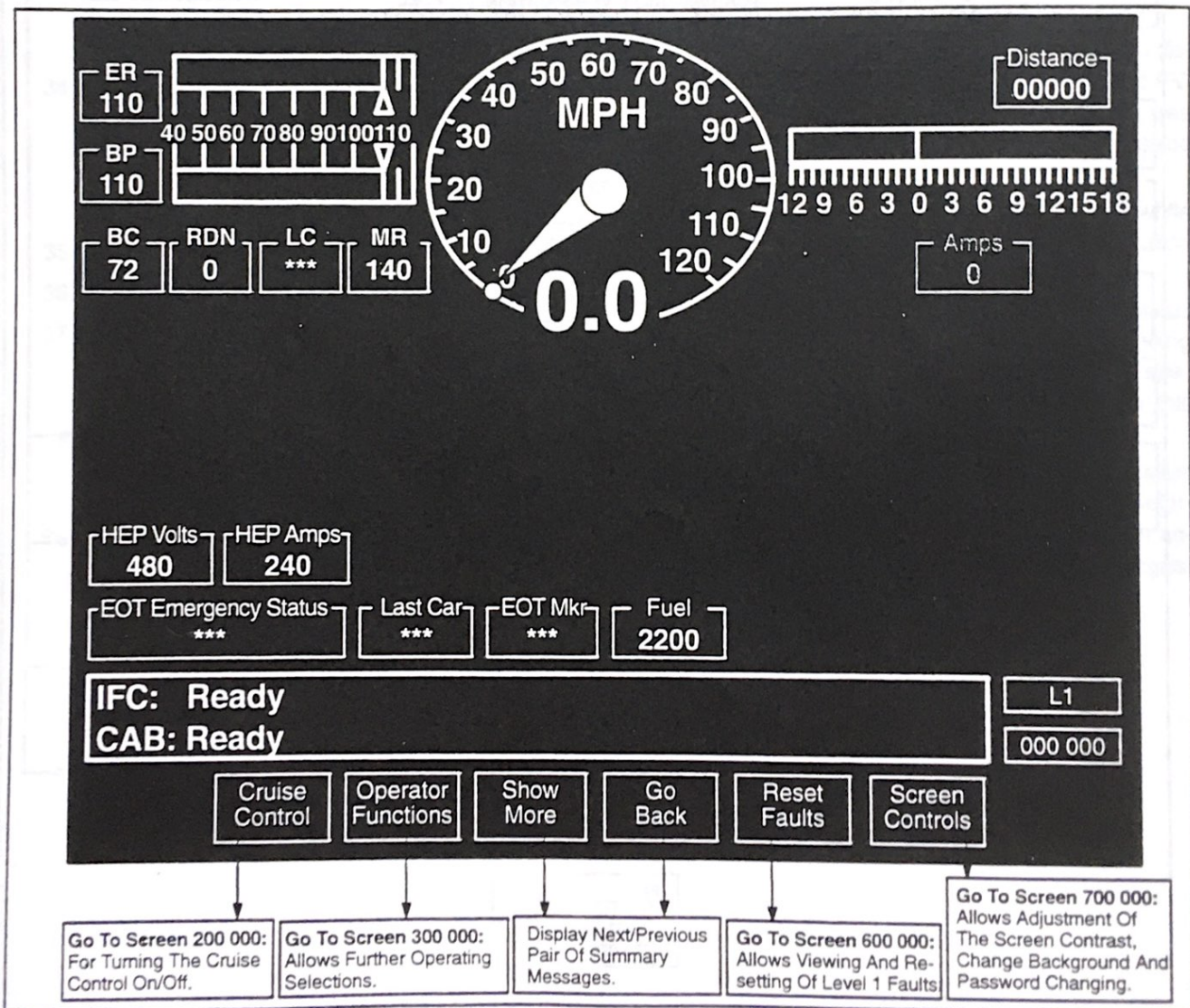


FIG. 61. MAIN OPERATION SCREEN (000 000). E-42579.



## OPERATOR FUNCTION SCREEN

Pressing the F3 key from screen 000 000 (Fig. 61) will display screen 300 000 (Fig. 62). This screen will give the operator access to the various operating systems.

Seven function keys are available:

1. DISTANCE COUNTER (Key Position F1).  
(Refer to **IFC**, Distance Counter section.)
2. AIR BRAKE SETUP (Key Position F2).  
(Refer to **AIR BRAKE EQUIPMENT** section.)

3. EOT SETUP (Key Position F3).  
(Refer to **EOT** section.)
4. CAB SIGNAL (Key Position F4).  
(Refer to **SAFETY DEVICES** section.)
5. OPERATOR TESTS (Key Position F6).  
(Refer to **IFC**, Operator Tests section.)
6. FUEL MONITOR (Key Position F7).  
(Refer to **IFC**, Fuel Monitor section.)
7. EXIT (Key Position F8).

Pressing this key returns operator to Main Operations Screen (000 000, Fig. 61).

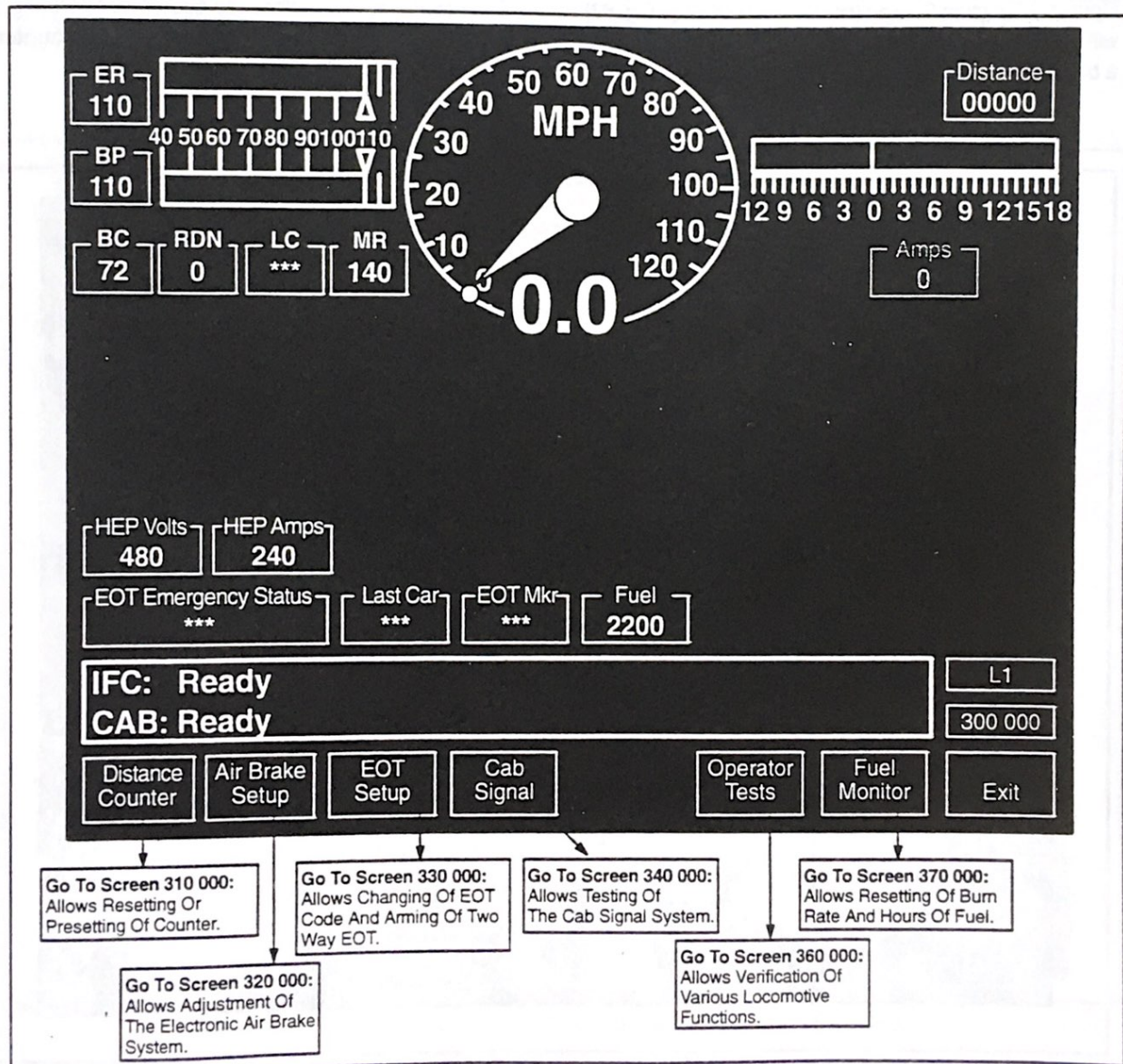


FIG. 62. OPERATOR FUNCTION SCREEN (300 000). E-42580.



## Distance Counter Screen

The Distance travelled (Fig. 63) function receives data from the motor tachometers to show distance travelled in feet. This function allows the Crew to set, reset or preset the counter for trip information. The counter operates independently from the counter on the other IFDs. The counter counts "up" when the locomotive is moving short-hood forward and "down" when the locomotive is in reverse unless changed through use of screen keys.

Pressing key position F1, **Distance Counter**, on the Operator Function Screen (screen 300 000, see Fig. 62) will display screen 310 000 (Fig. 63). The active keys and a brief description of operation are as follows:

1. Press key position F1 (**Count Up**) will start the counter from the current setting forward. The present locomotive direction will be considered forward.
2. Press key position F2 (**Count Down**) will start the counter from the current setting backward. The present locomotive direction will be considered forward.
3. Press key position F3 (**Stop Counter**) will stop the counter at the present reading. This key is only active if counting.
4. Press key position F4 (**Zero Counter**) will set the counter to zero unless the counter is operating. If counter is operating, press F3 (**Stop Counter**) first, then reset counter.

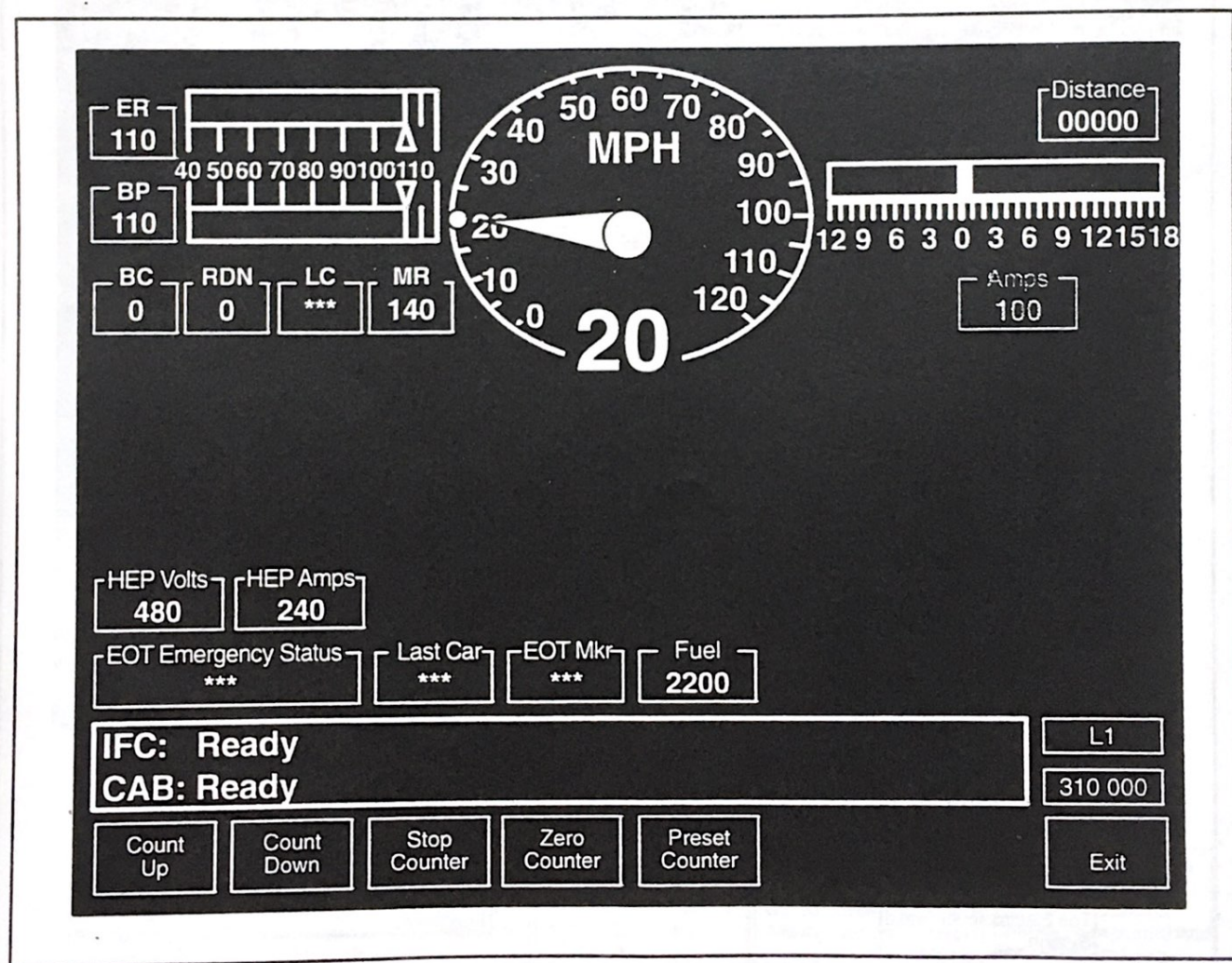


FIG. 63. DISTANCE COUNTER SCREEN (310 000). E-42582.



5. Press key position F5 (**Preset Counter**) will display screen 315 000 (Fig. 64). **Note: This key is only active if the counter is stopped.** The active keys and a brief description of operation are as follows:
  - a. Press key position F1 ("**UP**" Arrow) will increase the distance by 10,000 feet.
  - b. Press key position F2 ("**UP**" Arrow) will increase the distance by 1,000 feet.
  - c. Press key position F3 ("**UP**" Arrow) will increase the distance by 100 feet.
  - d. Press key position F4 ("**UP**" Arrow) will increase the distance by 10 feet.
  - e. Press key position F5 ("**UP**" Arrow) will increase the distance by 1 foot.
  - f. Press key position F6 (**Enter**) will exit the operator to screen 310 000 (Fig. 63) with the new preset distance.
  - g. Press key position F8 (**Exit**) will exit the operator to screen 310 000 with the old preset distance.
6. Pressing key position F8 (**Exit**) will return the operator to screen 300 000 (Fig. 62).

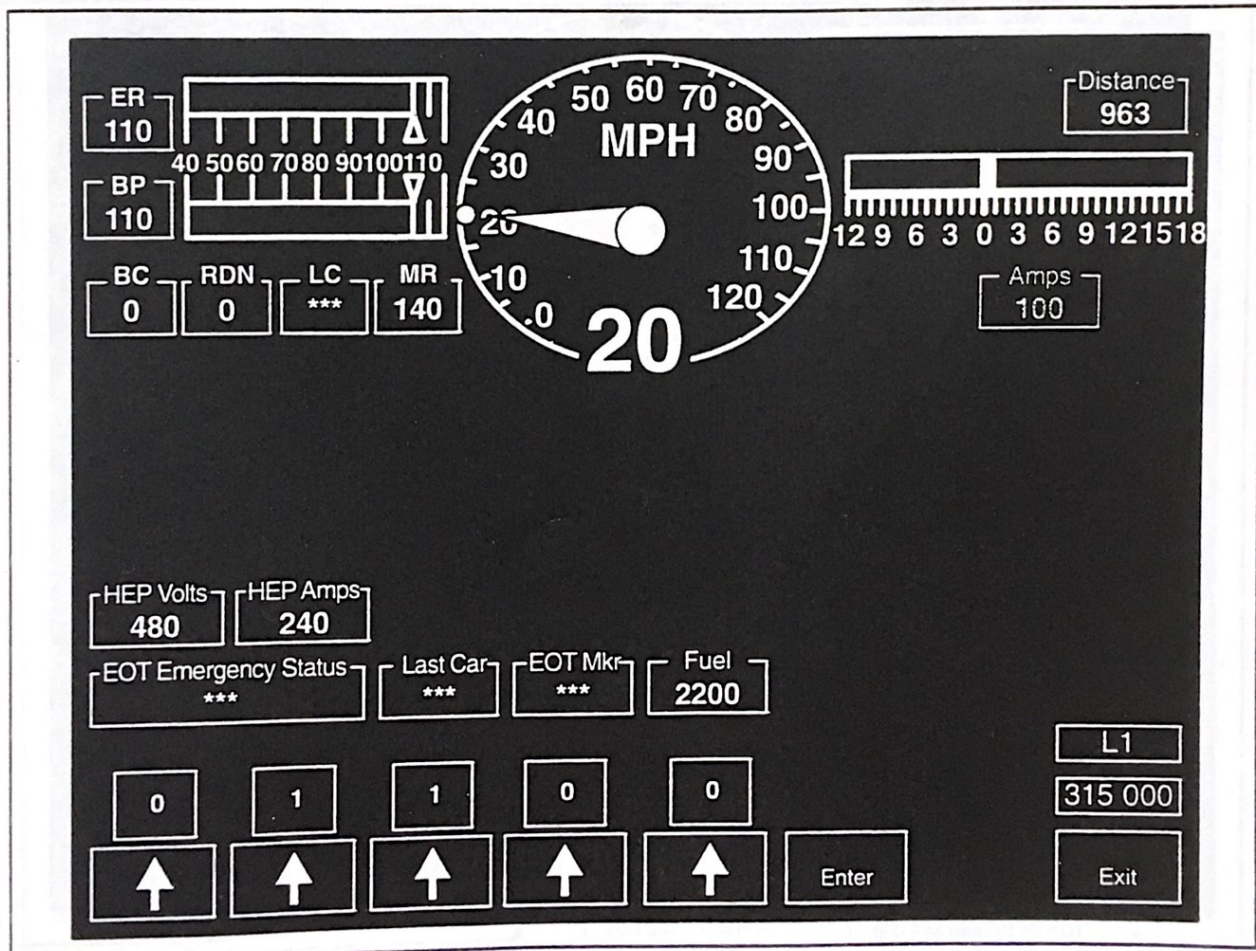


FIG. 64. DISTANCE COUNTER PRESET SCREEN (315 000). E-42583.



## Operator Test Screens

Pressing the F6 Key from screen (300 000, Fig. 62) will display screen 360 000 (Fig. 65). This screen will give the operator access to screens which allow testing/checking equipment.

Four function keys are available:

1. **ALERter MAG VALVE** (Key Position F2).

Key only active if locomotive speed is less than 0.5 MPH. (Refer to **SAFETY DEVICES** section.)

2. **SPEED CHECK** (Key Position F3).

Key only active if locomotive speed is greater than three (3) MPH. (Refer to **IFC, Speed Check** section.)

3. **AIR BRAKE DEP TEST** (Key Position F4).

Key only active if locomotive speed is less than 0.5 MPH. (Refer to **AIR BRAKE EQUIPMENT** section.)

4. **EXIT** (Key Position F8).

Pressing key position F8 (**Exit**) will return the operator to screen 300 000 (Fig. 62).

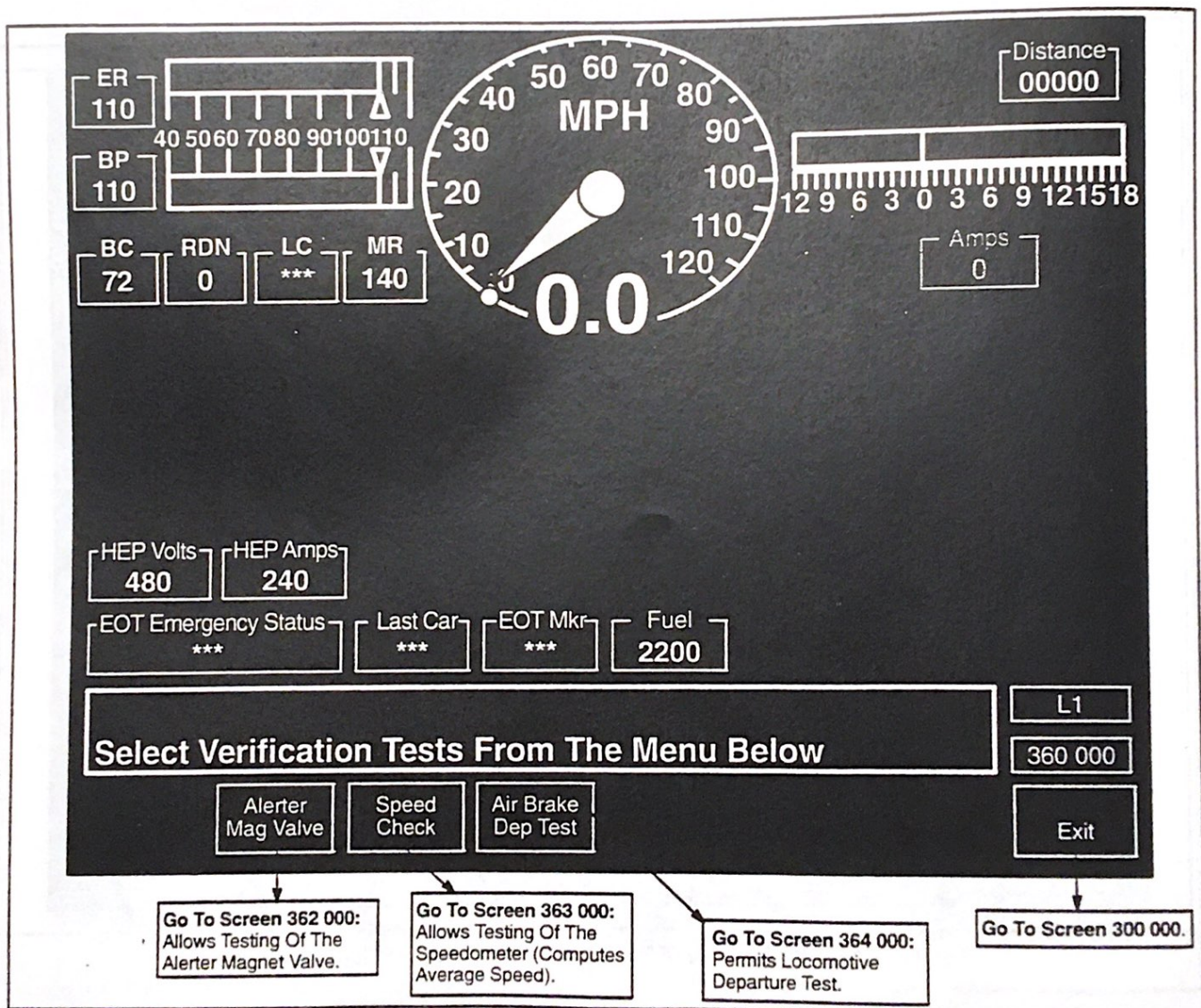


FIG. 65. OPERATOR VERIFICATION TEST SCREEN (360 000). E-42731.



## Speed Check Screen

The speed check function is used to verify the accuracy of the speedometer through a measured mile.

**NOTE:** Accuracy of this test depends upon maintaining a constant speed throughout the measured mile.

Pressing the F3 Key, **Speed Check**, from screen 360 000 (Fig. 65) will display screen 363 000 (Fig. 66). This screen will give the operator access to screens which allow testing/checking equipment.

1. At beginning of measured mile press F1, **Start Mile**. The Summary message area will read "Speed Check Started ... Waiting For Stop Button". The **Start Mile** button will disappear as the test is running.
2. Upon the end of the measured mile press F2, **Stop Mile**. The computer will stop the test and compute the average speed. The **Stop Mile** button will disappear after it is pressed.
3. The Summary message area will read "Average Speed For The Mile Was XXX.X".
4. **Exit** will return the display to screen 360 000 (Fig. 65).

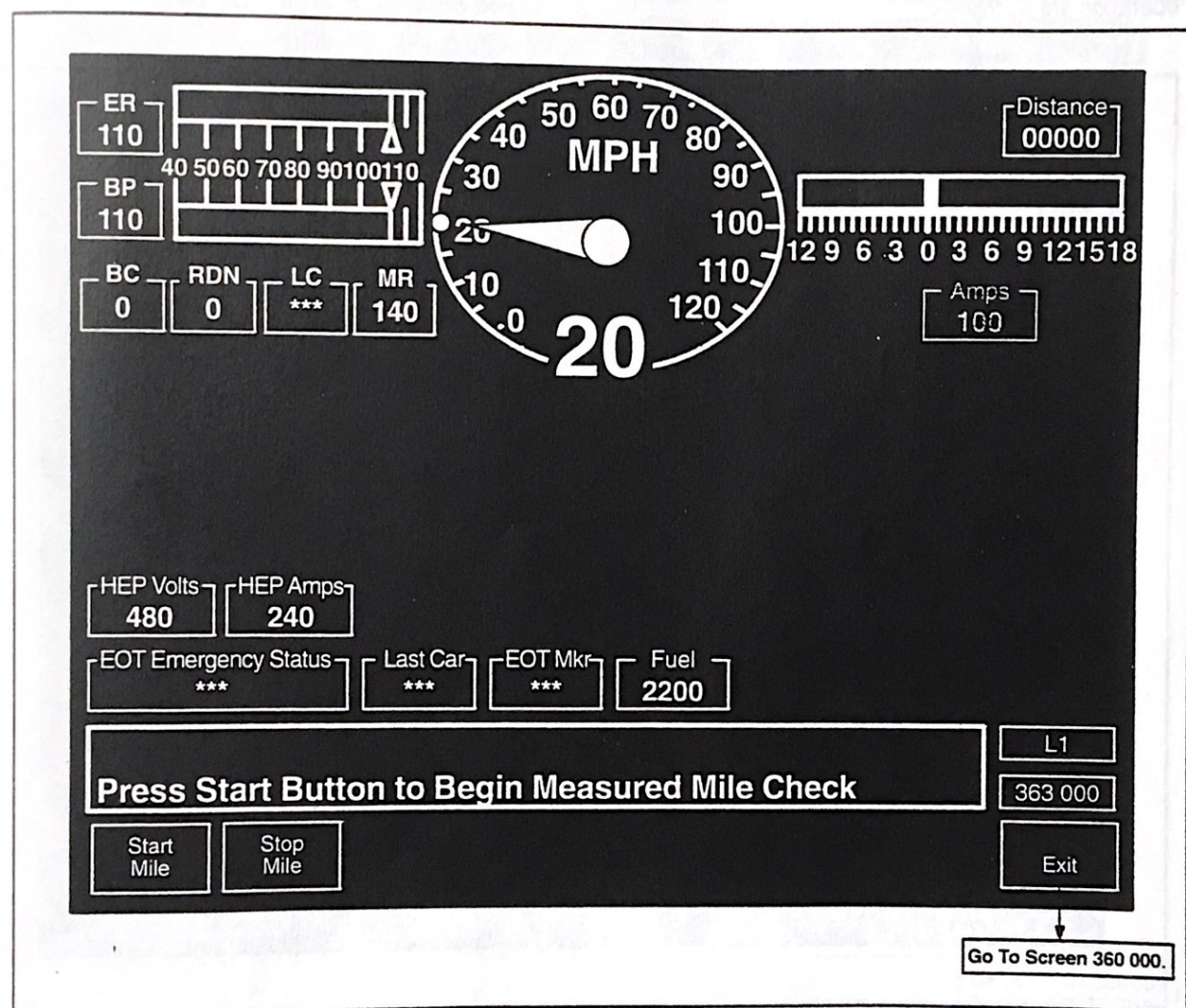


FIG. 66. SPEED CHECK SCREEN (363 000). E-42788.



## Fuel Monitor Screen

Fuel Monitor (Fig. 67) is a program enabling the operator to keep track of unit fuel consumption and fuel remaining. The right front and left rear sections of the four-compartment fuel tank have fuel level sensors. Total fuel is calculated by adding the readings from the two sensors then multiplying by two. Total fuel remaining in the fuel tank is an approximation. Observe sight glasses on each side of locomotive to determine fuel levels in each compartment. (Refer to **ENGINE/RADIATOR COMPARTMENT** section.)

Pressing key position F7, **Fuel Monitor**, on the Operator Function Screen (screen 300 000, see Fig. 62) will display screen 370 000. Follow Railroad procedures for this operation. The active keys and a brief description of operation are as follows:

**NOTE:** Gallons Per Hour is determined by taking Gallons Burned since last reset divided by Hours since last reset. The Hours Left is determined by taking Gallons Left and dividing by Gallons Per Hour.

1. Pressing key position F7 (**Data Reset**) will order the computers to reset the Burn Rate and Hours Of Fuel. This function is primarily used when fuel has been added to the tanks.
2. Pressing **Exit** will return the display to screen 300 000.

**NOTE:** If either Sensor 1 or 2 fail, "\*\*\*\*" will be displayed. If both sensors fail, Gallons Per Hour and Hours Of Fuel will also read "\*\*\*\*."

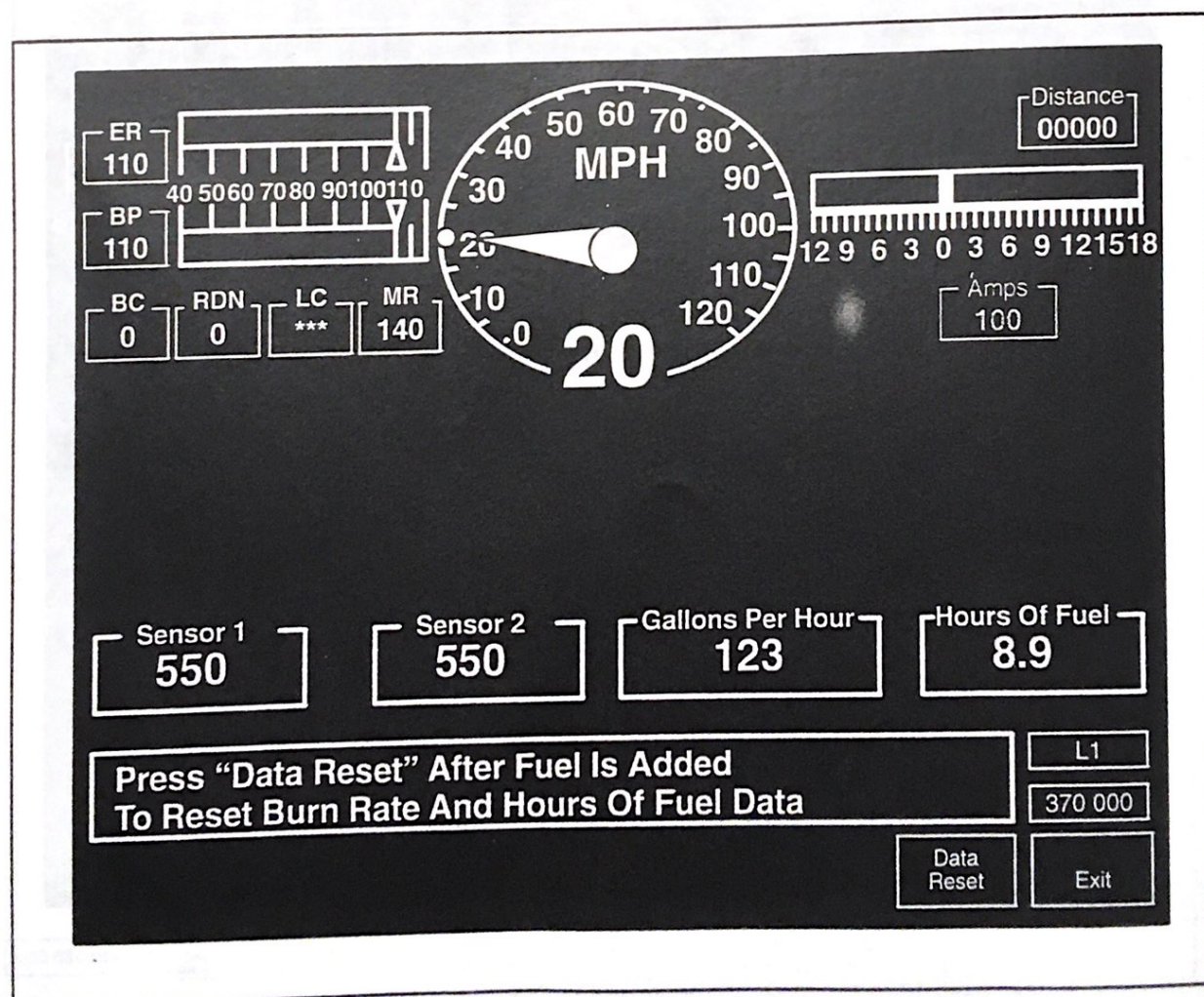


FIG. 67. FUEL MONITOR SCREEN (370 000). E-42592.



## OPERATOR CONTROLS SCREEN

**NOTE:** All data is still displayed and updated on the display screen while the operator is adjusting screen parameters.

The Main Operator Screen Controls (Fig. 68) is a program which gives the operator the ability to change IFC screen brightness, toggle screen background for day/night and/or change password for access to different operating levels.

Pressing key position F7, **Screen Controls**, on the Main Operation Screen (screen 000 000, see Fig. 61) will display screen 700 000 (Fig. 68). The active keys and a brief description of operation are as follows:

1. Pressing key position F1 (**Alarm Test**) will display alarm lights.
2. Pressing key position F3 (**Brighter Screen**) will increase the screen brightness one step.
3. Pressing key position F4 (**Dimmer Screen**) will decrease the screen brightness one step.
4. Pressing key position F7 (**Enter Password**) will display screen 770 000. This screen is used to gain access to the different IFC operating levels and is not needed in Level 1 operation.
5. Pressing **Exit** will return the operator to screen 000 000 (Fig. 61).

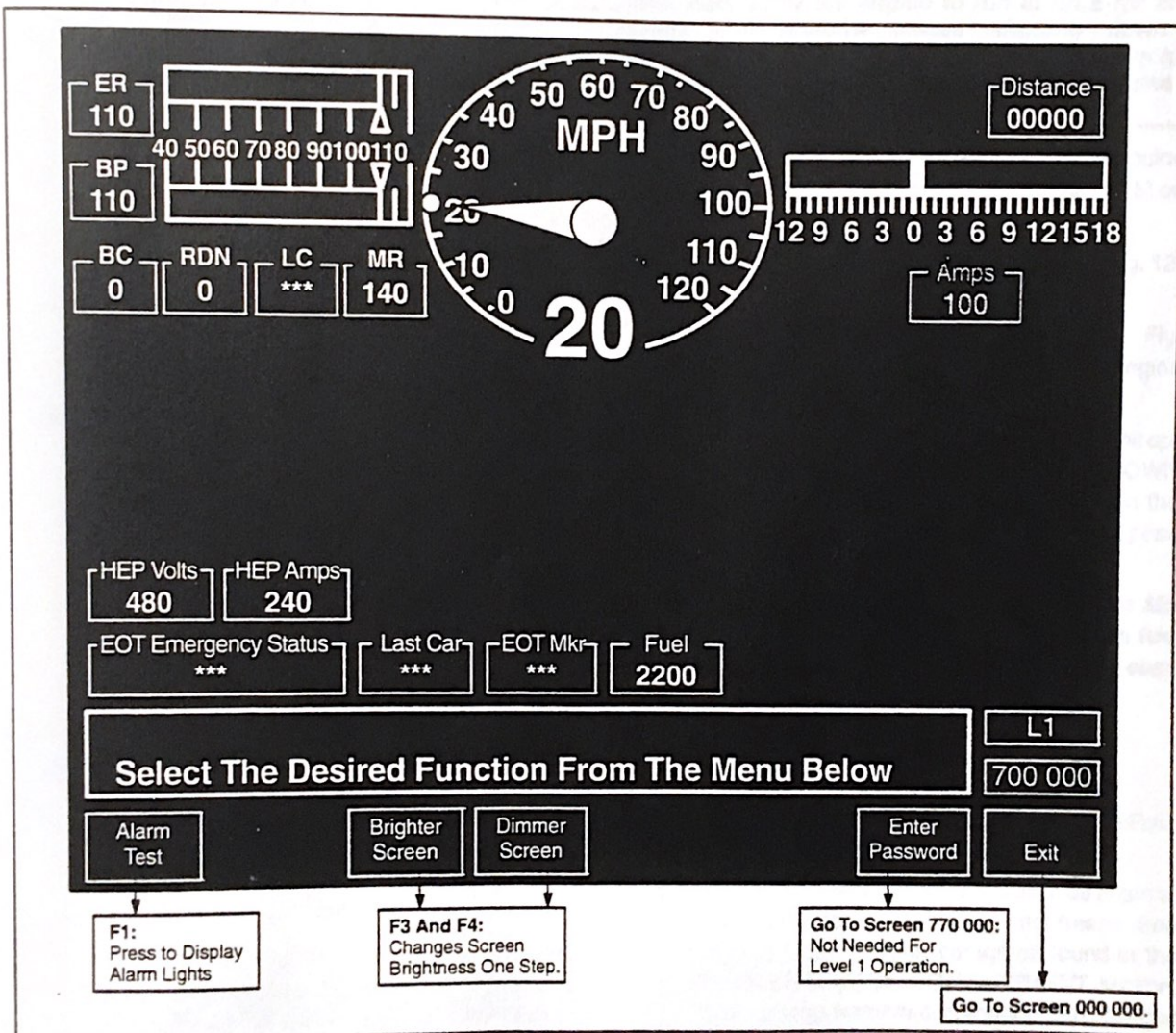
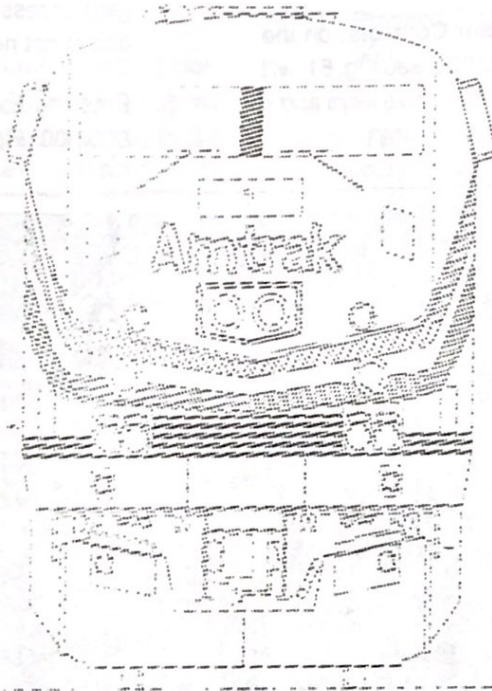


FIG. 68. OPERATOR SCREEN CONTROLS (700 000). E-42594.







## ENGINE STARTING/SHUTDOWN

### STARTING DIESEL ENGINE

1. Make sure locomotive is properly secured.
2. Perform standard railroad operations boarding locomotive.
3. Close the Battery switch (Item 1, Fig. 13) located behind the door under the EC panel.
4. Turn ON all applicable circuit breakers in the top row of breakers on the EC panel.
5. Turn ON Control and Engine Run circuit breakers (Items 18 & 20, Fig. 5) on control console of lead unit.
6. Make sure MU Emergency pushbutton (Item 4, Fig. 5) is in Run Position.
7. Press the Battery Connect Pushbutton (Item 33, Fig. 12) located under the EC Panel. **This pushbutton must be pressed at start-up or the locomotive will not crank.**
8. Turn ON **ALL** circuit breakers in the second row of breakers on the EC panel.
9. Check the IFDs for any Fault Messages. If the display says "Won't Crank," the unit will not attempt to crank.
10. Verify the Engine Control (EC) switch (Item 19, Fig. 12) in the START position.
11. At the Start Station (Fig. 70), located near the engine (Fig. 69), turn the Start switch to the PRIME position. Hold until solid fuel flow with no bubbles shows in the sight glass (Fig. 71) and fuel pressure gauge shows approximately 50–55 psig.
12. Turn the switch to the START position and hold until the engine starts.

**NOTE:** If unit was run out of fuel, refer to TROUBLESHOOTING section.

**CAUTION:** Do not discharge the battery excessively by repeated attempts to start. If the first two or three tries are unsuccessful, recheck the starting procedure.

**NOTE:** For Dead Batteries refer to TROUBLESHOOTING Section.

**NOTE:** On start-up, note the following:

1. There will be a two to four second delay between the time the switch is placed in the START position and the diesel engine starts to rotate.

2. If proper engine lube-oil pressure does not build up within approximately 40 seconds, fuel will shut off preventing the engine from running.

### SHUTTING DOWN DIESEL ENGINE

**NOTE:** In an emergency, press any of the Engine Stop buttons or MU shutdown to shutdown engine instead of following listed steps.

1. Move the Combined Power Handle to IDLE.

**CAUTION:** After a locomotive has operated under full load, allow the engine to run at IDLE for at least five minutes before shutting down. Otherwise, immediate shutdown after such operation could be harmful to some engine components.

2. Open the Control, Generator Field and Engine Run circuit breakers (Items 18, 19 & 20, Fig. 5) on the control console right.
3. Move the Engine Control switch (Item 19, Fig. 12) to START.
4. Press the Engine Stop pushbutton (Item 9, Fig. 12) on the Engine Control panel or at the Engine Start Station (Fig. 70).
5. To shut down all engines when in multiple-unit operation, depress the green/red MU SHUTDOWN pushbutton (red IN, green OUT) located on the control console right. Return button to RUN position after all units have shutdown.

**NOTE:** On some older units, pressing the MU Shutdown pushbutton will not turn off the fuel pumps. Pushing the STOP pushbutton on each unit will turn them off.

6. Close the windows and doors.
7. Open the Battery switch (Item 1, Fig. 13).
8. Secure the locomotive in accordance with Railroad Rules and Procedures.
9. In freezing weather, precautions must be taken to see that the cooling water does not freeze. See Draining Cooling Water paragraph found in the **ENGINE/RADIATOR COMPARTMENT** section. Drain cooling water in accordance with Railroad Rules and Procedures.



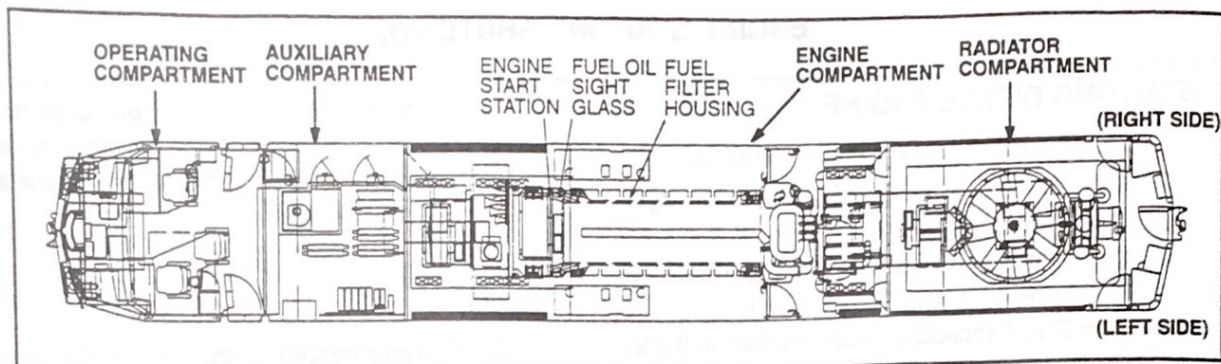


FIG. 69. ENGINE START EQUIPMENT LOCATION. E-42792.

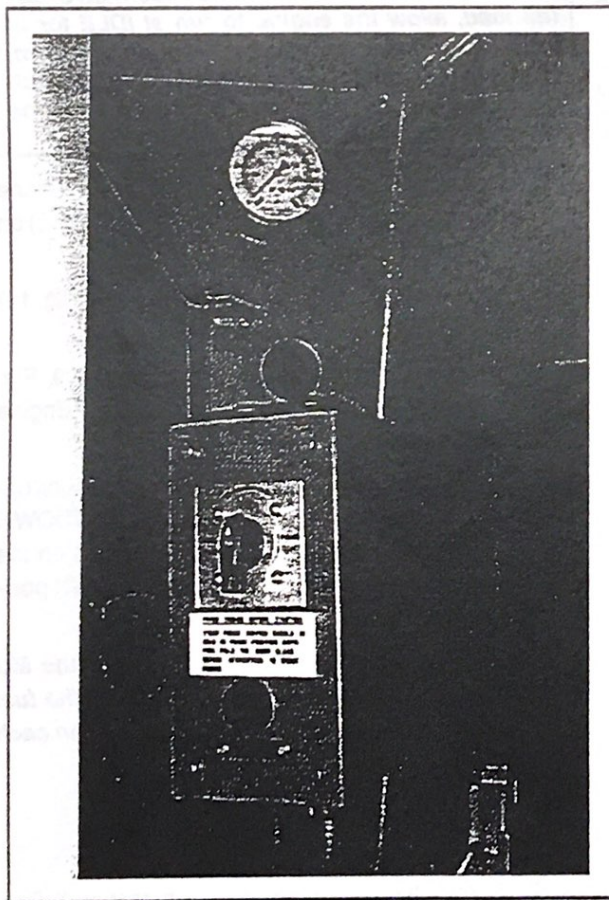


FIG. 70. ENGINE START STATION. E-42793.

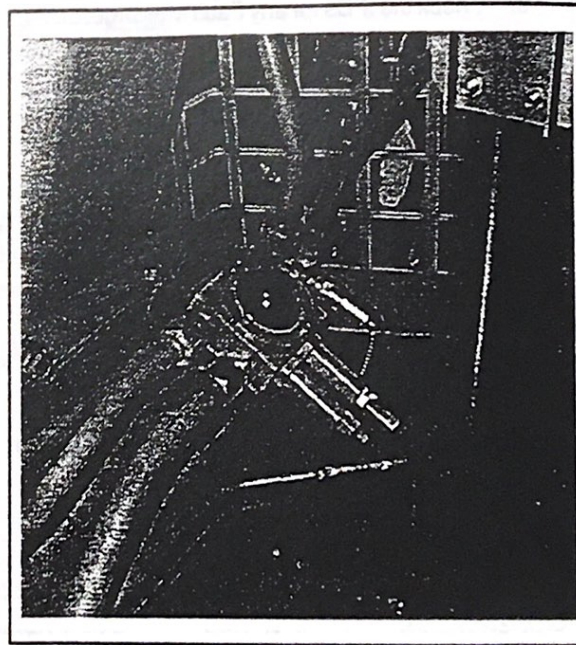


FIG. 71. FUEL OIL SIGHT GLASS. E-42794.



## OPERATING RESTRICTIONS

**NOTE:** If needed, refer to Figure 5 for indicated device locations.

**WARNING: STOPPING HAZARD.** Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 50 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

**POWER BRAKING RESTRICTION**

The purpose of the Power Braking restriction is to prevent excessive use of air brakes while high tractive effort is applied. In Power Braking, automatic limits are imposed by the control system as follows.

**Passenger Operation**

The passenger operation restriction occurs when the brake pipe cut-off pilot switch is in the Passenger Position and there is a Minimum Automatic Brake Application (Min. Brake) OR an Automatic Brake Application beyond Minimum Brake (Service Brake).

**NOTE:** This restriction also applies if the brake pipe cut-off pilot switch is in Freight Mode AND there is a Service Brake Reduction greater than Minimum Reduction.

1. If brakes are applied for more than 30 seconds, Combined Power Handle is in NOTCH 5 or greater and locomotive speed is 12 MPH or greater, the computer will limit Combined Power Handle call to NOTCH 4. Combined Power Handle call will be gradually reduced one notch at a time every four (4) seconds if handle is above NOTCH 4.
2. A Summary Message will appear on the IFD: **Load Limited: Too Much Power Braking.**
3. Condition will reset after the operator moves Combined Power handle to NOTCH 4 or less and there is no brake application for **two seconds**.

**Freight Operation**

The freight operation restriction occurs when the brake pipe cut-off pilot switch is in the Freight Position AND there is a Minimum Automatic Brake Application.

**NOTE:** If an Automatic Brake Application greater than Minimum Reduction is made, the power braking restriction reverts to Passenger Operation.

1. If brakes are applied for more than three minutes, Combined Power Handle is in NOTCH 5 or greater and locomotive speed is 12 MPH or greater, the computer will limit Combined Power Handle call to NOTCH 4. Combined Power Handle call will be gradually reduced one notch at a time every four (4) seconds if handle is above NOTCH 4.
2. A Summary Message will appear on the IFD: **Load Limited: Too Much Power Braking.**
3. Condition will reset after the operator moves Combined Power handle to NOTCH 4 or less and there is no brake application for **two seconds**.

**TRACTION MOTOR STALL PROTECTION**

A traction motor stall condition can occur when the Combined Power handle is in NOTCH 1 or greater and the motor speed indicates 0 MPH.

1. If brakes are applied for more than ten seconds, Combined Power Handle is in NOTCH 1 or greater, traction motor temperature is greater than 140°C, motor current is greater than 1100 amps, and traction motor speed is 0 MPH, the computer will restrict alternator current.
2. An alarm will sound for five seconds.
3. A Summary Message will appear on the IFD: **Please Move Throttle To Idle.**
4. Condition will reset after the operator moves Combined Power handle to IDLE for **two seconds**.

**PASSING THROUGH WATER**

Do not exceed two or three MPH if there is water over the rails. Do not pass through water that is over 2.5 in. above the top of the rail.

**PASSING OVER RAILROAD CROSSINGS**

Do not pass over railroad crossings at full power – traction motor damage may result. While all units are passing over the crossing, reduce power by moving the Combined Power Handle to NOTCH 5, or below.



## COLD WEATHER ENGINE STARTING/WARM-UP

During cold weather conditions, when a locomotive has been shutdown for a period of time, locomotive horsepower will automatically be derated until the lubricating oil temperature reaches a predetermined level. This special warm-up period is required to avoid equipment failure from thermal or overload strain. See Alarms, Safeguards, Power Derations And Shutdowns found in **TROUBLESHOOTING** section of this manual.

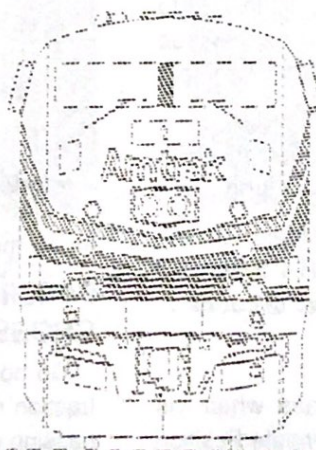
## OPERATING WITH OTHER TYPES OF UNITS

This locomotive is equipped with a traction motor thermal model which computes traction motor temperatures. This model will reduce locomotive output as required to protect the traction motors.

If the units in the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction motor ratings on any of the units in the locomotive consist. A locomotive with high horsepower per axle will develop more tractive effort at any given speed than will units of lower horsepower per axle and will, therefore, tend to overload sooner at lower speed.

When the leading unit is slipping excessively, the Power-Limit switch (Item 25, Fig. 5) can be moved to NOTCH 7 to reduce the power and engine speed on this unit while the trailing units are operating at full power. This will reduce the tractive effort on the Leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.





## OPERATING PROCEDURES

**NOTE:** If needed, refer to Figures 5 and 12 for indicated device locations.

### MOVING A TRAIN

1. Close the Generator Field circuit breaker on the control console right.
2. Move the **Reverser** Handle to the desired direction of movement.
3. Release the brakes completely.
4. Advance the **Combined Power** Handle. The **Combined Power** Handle has notches (IDLE up to Notch 8), with each successive notch representing an increase in power, or locomotive tractive effort.

Starting a train depends on type, length, weight, grade, condition of rail and amount of slack in the train. This locomotive is designed to have easily controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the **Combined Power** Handle is moved from the lowest to the highest notch. The engineer can easily control the amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing the **Combined Power** Handle position.

**WARNING: STOPPING HAZARD.** If 24 Volt power loss and Locomotive battery power loss to the NYAB/KNORR System occurs or system experiences an internal fatal failure, on LEAD UNIT, while train is in motion, a SERVICE Brake application is made (BP goes to zero and BC goes to 90 psig). Operator may NOT bail off BC pressure. Operator may still initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Control Console Left or moving the Automatic Brake Handle to EMERGENCY position.

### STOPPING A TRAIN

Follow Railroad procedures for this operation.

**CAUTION:** The control system of this locomotive will slightly delay movement from power to dynamic braking. If however, other locomotives in the consist do not have this feature, to prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with the Combined Power Handle at IDLE.

### REVERSING THE LOCOMOTIVE

1. Bring the locomotive to a full stop.
2. Move the **Reverser** Handle to the opposite direction.
3. Release the brakes.
4. Advance the **Combined Power** Handle.

### DYNAMIC BRAKE OPERATION

The Dynamic Braking System operates to control train speed on down-grades and to reduce train speed when stopping. This is accomplished by converting train motion energy (speed) into electrical energy. In dynamic braking, the traction motors become generators, which are turned by the locomotives wheels to produce electrical power (braking current). This electrical energy is dissipated in the form of heat in the grid resistors. Grid blower motors are connected across a tap of some of the grid resistors to provide the blower motors with electrical power.

Connecting the traction motor circuits for dynamic braking is accomplished by moving the Combined Power handle to the SETUP position. This changes the Braking Switch (BKT) and the Brake-Motor-Isolation Switch (BMS) from MOTORING to BRAKING, connects the traction motor fields in series, and connects the traction motor armatures to the grid resistors.

Placing the Combined Power handle in the MINIMUM position causes the Braking Contactor (B1) and the Power (P) contactors to close, applying rectified traction alternator voltage to the traction motor fields. (P contactors close the motor armature circuits.) The traction motors become generators to produce braking current.

**NOTE:** If BCP is applied from independent brake, Dynamic brake will be derated as a function of speed.

The amount of dynamic braking is selected by setting the Combined Power handle between the MINIMUM and MAXIMUM positions. A Braking Control Potentiometer (BCP), located in the Master Controller, converts the setting of the handle to an electrical signal that is used to establish the desired level of dynamic braking.



## Applying Dynamic Brake

Applying dynamic braking is done in the following manner:

**NOTE:** *Dynamic brake cannot be applied on a locomotive which has any traction motor manually or automatically cut out. Also, dynamic braking is dropped when locomotive speed falls below five MPH and is not available again until after eight MPH.*

1. Move **Combined Power** Handle to IDLE.
2. Move the **Combined Power** Handle to SET-UP position; pause, then advance the handle into the BRAKING sector as desired.
3. After the slack is bunched, manipulate the **Combined Power** Handle until the desired braking effort is obtained. Observe and correct braking effort during the initial period of Dynamic Brake application.

**NOTE:** *Wheelslip warning may occur while in dynamic braking. This indicates wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. Until the warning stops, reduce the Combined Power Handle position.*

**NOTE:** *When Dynamic braking is controlled by the Combined Power Handle, the NYAB/KNORR System releases BC pressure from an Automatic air brake application on the locomotives.*

## Releasing Dynamic Brake

Release dynamic braking by moving the **Combined Power** Handle to the IDLE position.

## BLENDED BRAKING SYSTEM

The Blended Braking System utilizes both the dynamic brakes and the friction brakes on the locomotive to reduce train speed. To use the Blended Braking System the operator must place the Combined Power handle to IDLE position and then move the Automatic Brake Valve handle into the Application Zone. Blended brake is nullified if B.C. pressure is bailed off.

When the Automatic Brake Valve handle is moved into the Application Zone, the electronic air brake develops

an output air pressure and a reference is sent to the Aux Controller that is proportional to the actual air pressure. AUX scales the signal to obtain the operator-desired braking effort. EAB also sends an input to CAB to set up for brake mode.

## Applying Blended Brake

Automatic air brakes apply on the train (with **Combined Power** Handle in IDLE) including the locomotive while Dynamic braking is applied to the locomotive. Top priority in blended braking is for dynamic brakes with any additional braking necessary supplied by the air brakes. Blended braking is controlled by the Automatic Brake Handle (Fig. 15). If the Automatic Air Brake handle is moved to the EMERGENCY position, higher levels of dynamic brake (supplemented by air brakes) is applied on the locomotive, and the train air brakes go into Emergency application.

## Releasing Blended Brake

Release blended braking by moving the Automatic Brake Handle to the RELEASE (Running) position.

## SETTING UNIT AS A LEADING UNIT

To set-up the locomotive as a Lead unit of a consist, first make the necessary preliminary preparations for operation then proceed as follows:

### Air Equipment Set-Up

1. Apply parking brake.
2. Move the Independent Brake handle to the FULL APPLICATION position.
3. Move the brake pipe cut-off pilot switch to the TEST position on Brake Controller (Fig. 15).
4. Move Automatic Brake handle to RELEASE position.
5. Wait for equalizing reservoir pressure to increase above current brake pipe pressure.
6. Move the brake pipe cut-off pilot switch to FREIGHT or PASSENGER position.
7. Adjust regulating valve setting according to Railroad Rules and Regulations.
8. Test the air brake in accordance with Railroad Rules and Regulations.
9. Release parking brake before moving locomotive.



## Electrical Set-Up

1. Close the Control circuit breaker on the control console right. (The Control circuit breaker must be closed on the Lead unit only.)
2. Close the Engine Run circuit breaker. (This circuit breaker must be closed on the Lead unit only.)
3. Close the Dynamic Brake circuit breaker.
4. Close the required circuit breakers on the Engine Control (EC) panel.
5. Move the MU Headlight Set-Up switch to the required position.
7. Insert the **Reverser** Handle into the Controller.
8. When ready to move locomotive, move EC switch to RUN position, close Generator Field circuit breaker, and move Reverser handle to desired direction.
9. Verify that the HEP Control Panel (Fig. 57) is set as required.
10. Operate the locomotive in accordance with operating procedure.

## SETTING UNIT AS A TRAILING UNIT OR PUSH

To set-up the locomotive as a Trail unit of a consist, or Push, proceed as follows:

**NOTE: Refer to ELECTRONIC AIR BRAKE section of this manual for Air Brake Setup if more information is needed.**

### Air Equipment Set-up

1. Make a Full Service application with the Automatic Brake handle.
2. Wait for air exhaust to stop.

3. Move the brake pipe cut-off pilot switch to TRL position.
4. Move the Automatic Brake handle to the HANDLE OFF position.
5. Place the Independent Brake handle in the RELEASE position.

## Electrical Set-Up

1. Move the **Reverser** Handle to OFF and remove the handle.
2. Open the Generator Field, Control, Engine Run and Dynamic Brake circuit breakers on control console right.

**NOTE: Control circuit breaker must be closed (ON) in Push Mode.**

3. Turn off desired circuit breakers on top row for Trail/Push depending on territory to be operated in. The second row of breakers **MUST BE ON** for Trail/Push operation. The Running Lights circuit breaker may be positioned as desired.
4. Place the MU Headlight Set-Up switch in the proper position.
5. Verify that the HEP Control Panel (Fig. 57) is set as required.

## BRAKE PIPE LEAKAGE TEST

A brake-pipe leakage test can be performed according to Railroad Rules and Regulations.

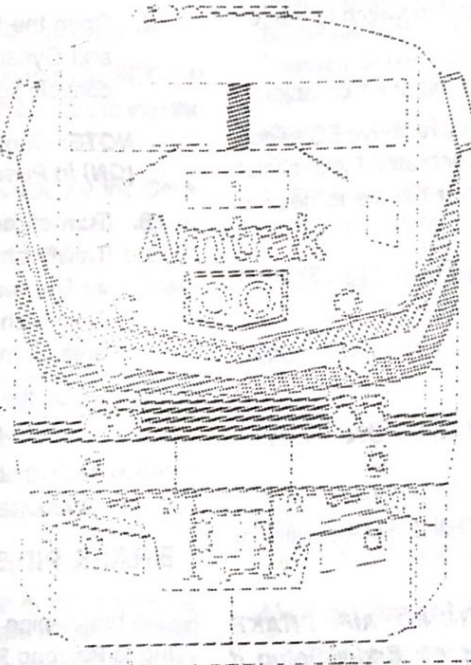
## SLOW SPEED BACKING

Refer to **Slow Speed Backing** section.

## CRUISE CONTROL

Refer to **Cruise Control** section.







## TROUBLESHOOTING

### INTEGRATED FUNCTION CONTROL (IFC)

#### General Information

The IFD (through the IFC system) is a fast and accurate means of communications between the locomotive operator and computers. The IFD can be utilized in several ways:

1. If an abnormal operating condition (called a "FAULT") is detected, the computers will initiate the ALARM mode. In the ALARM mode, the computer uses the IFD to alert the operator to the FAULT by displaying a description of the FAULT and, in some cases, ringing the Alarm bell.

**NOTE: All FAULT messages are preceded by a four digit Fault Number.**

2. The FAULT detected may require that certain operating restrictions be imposed on the locomotive as a means of protecting the locomotive's equipment. The locomotive computers impose the necessary restrictions and inform the operator of those restrictions through the IFD in the form of SUMMARY messages.
3. A SUMMARY message on the display, informs the operator of the general status of the locomotive's operating condition, its computers, restriction placed on the locomotive due to faults and, in some cases, the status of the display itself.

**NOTE: A SUMMARY message is not preceded by a number.**

4. The FAULT is recorded in a FAULT "Log" for later review by maintenance personnel.
5. The operator can use the IFD to review active FAULTS and their related restrictions (SUMMARY messages). The IFD also enables the operator to reset FAULTS, and attempt to return the locomotive to normal operation.

**NOTE: In accordance with railroad selected options, in some cases, the ability to reset certain FAULTS has been restricted to maintenance personnel.**

#### Message Display

Summary and Fault messages are displayed on the IFD Operation Display Screen in the Summary Message Area.

**NOTE: Several levels of information access are available through the IFD, but only Level 1 Operations are discussed in this publication.**

#### Messages At Locomotive Start-up

Certain SUMMARY messages, such as "Wait," "Ready," "Isolate," etc., are intended to inform the operator of the condition of the locomotive. These are special SUMMARY messages and are not a result of a FAULT. They require no reset and are not stored in the FAULT log.

#### Operating Modes

After the locomotive computers have been powered-up and are operating normally, three modes of operation are available:

1. READY mode
2. ALARM mode
3. FAULT mode

#### READY Mode

READY indicates that all of the locomotive systems are functioning properly, and the locomotive is "ready" to operate at full power. READY can be displayed in one of three ways:

1. READY appearing alone indicates that there have been no FAULTS detected, or reset.
2. "READY-Work Report Stored" indicates a FAULT has occurred, it has been reset, and all operating restrictions imposed by the FAULT have been removed.
3. Some FAULTS do not impose operating restrictions on the locomotive. When this type of FAULT occurs, "READY - Fault Message Stored" will be displayed.

**NOTE: As can be seen on the SUMMARY message list, Page 105, these READY messages are the three lowest priority messages. They will not be displayed if higher priority SUMMARY messages (operating restrictions) exist unless "SHOWMORE" is pushed.**



ALARM Mode

The computers check locomotive operation on a continuing basis. If an abnormal condition (FAULT) is detected, the ALARM mode may be initiated by the locomotive computers.

**NOTE:** If the computer initiates the ALARM mode, when the IFD is operating in any other mode, it will interrupt that mode to display the ALARM. When the ALARM mode is completed, the display will return to its previous operating mode.

When the ALARM mode is initiated, a description of the problem will be displayed in the IFD Summary Message Area in the form of a highlighted FAULT MESSAGE, the words "Silence" will appear in the IFD Soft

Key Message Area and, in most cases, an alarm bell will sound.

**NOTE:** When any unit in the locomotive consist initiates an ALARM, the alarm bell on all locomotives will ring. All P42-DC locomotives in the consist are notified of the ALARM through the SUMMARY message, "Alarm from Other Unit." If the initiating unit is a P42-DC locomotive, a message describing the FAULT and "Silence" will appear on the IFD Function Screen of that unit as described above. Pressing "Silence" on the initiating unit will quiet the ALARM on all trainlined units. The bell can only be silenced from the initiating unit therefore, "Silence" does not appear on any other units in the consist. See "Silence" soft key.

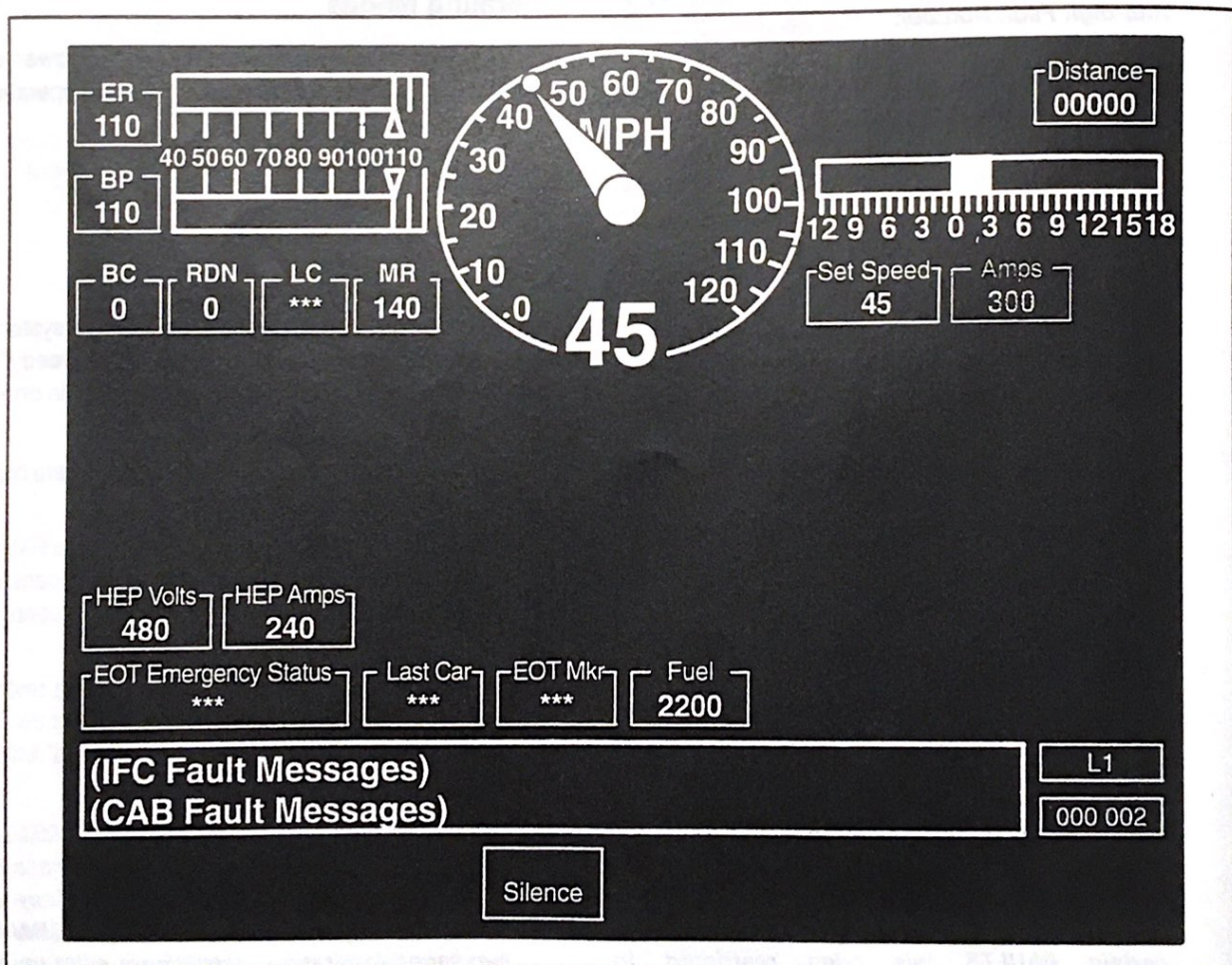


FIG. 72. OPERATOR ALARM SCREEN (000 002). E-42789.



## "Silence" Soft Key

"Silence" is the only soft key that appears in the ALARM mode. It does not appear in any other mode of operation.

When "Silence" is pressed OR if 30 seconds pass, the ALARM mode is terminated, the bell will stop ringing, the words "Silence" will disappear. The highlighted line in the Summary Message Area will change from the FAULT message to a SUMMARY message to show the operating restriction which has the greatest effect on the locomotive's ability to operate normally (highest priority SUMMARY message).

**NOTE: A few ALARMS are considered so serious that the bell cannot be silenced. In the cases of ENGINE SHUTDOWN, for example, no "Silence" soft key appears. The EC switch on the SHUTDOWN unit MUST be turned to the START position to silence the bell.**

## FAULT Mode

As mentioned before, as a result of abnormal conditions (FAULTS), it may be necessary to protect the locomotive's equipment, by placing certain operating restrictions on the locomotive.

The FAULT mode of operation allows the operator to return the locomotive to the READY condition unless conditions exist that prohibit READY operation.

The restrictions imposed are displayed in the form of SUMMARY messages. In resetting FAULTS, it is important to know the following about SUMMARY messages:

1. If a FAULT is reset, the operating restrictions imposed by it are removed and the related SUMMARY messages are no longer displayed.

**NOTE: Some FAULTS may require manual reset of some other device before the fault can be reset through the IFD screen. See Summary Message Resets.**

2. Several FAULTS may impose the same operating restrictions and will therefore, result in the same SUMMARY message.

**NOTE: A SUMMARY message will only be displayed once (by priority) regardless of the number of active FAULTS which generate the same message.**

3. A FAULT may result in more than one operating restriction and therefore, more than one SUMMARY message.
4. Under normal operating conditions, the highest priority SUMMARY message will be displayed. Highest priority being those conditions which have the greatest effect on the locomotive's ability to operate normally. Other summary messages can be displayed by "SHOWMORE."
5. A list of SUMMARY messages by priority appears on page 105.

## IFC Reset

**NOTE: Always attempt to reset faults through the IFD screens. Only reset the IFC after all attempts to restore locomotive to normal operation have been tried.**

Resetting the IFC may resolve a momentary communication loss to the IFC. Sustained IFC communication failures or hardware failures cannot be reset by the operator.

To reset the IFC computer, proceed as follows:

**CAUTION: If the Battery Charge and Computer circuit breaker is turned off (OPENED) on the LEAD unit while the train is in motion, a FULL SERVICE Brake application is made at a SERVICE rate (BP goes to zero) with PCS. In addition, if unit is LEAD or TRAIL, power (load) is dropped.**

1. Turn off (OPEN) the Battery Charge and Computer circuit breaker (Item 18, Fig. 12) on the EC Panel.
2. Wait five (5) seconds.
3. Turn on (CLOSE) the Battery Charge and Computer circuit breaker on the EC Panel.
4. Wait until the computer reboots and IFD screens are displayed again.



## MAIN OPERATION SCREEN

The Top Level Screen (000 000, Fig. 73) will be displayed on all IFDs and the message line will display any IFC or CAB Operator messages.

Six function keys are available:

1. CRUISE CONTROL (Key Position F2).  
(Refer to **CRUISE CONTROL** section.)
2. OPERATOR FUNCTIONS (Key Position F3).  
(Refer to **IFC, Operator Functions** section.)
3. SHOW MORE (Key Position F4). Active only if there are more messages to view.

4. GO BACK (Key Position F5). Active only if there are more messages to view.

**NOTE:** Pressing key positions F4 and F5, *Show More and Go Back*, will display the next or previous pair of Summary Messages.

5. RESET FAULTS (Key Position F6). Displayed only if there are active faults that can be reset.  
Pressing this key will display screen 600 000 (Fig. 74).
6. SCREEN CONTROLS (Key Position F7).  
(Refer to **IFC, Screen Controls** section.)

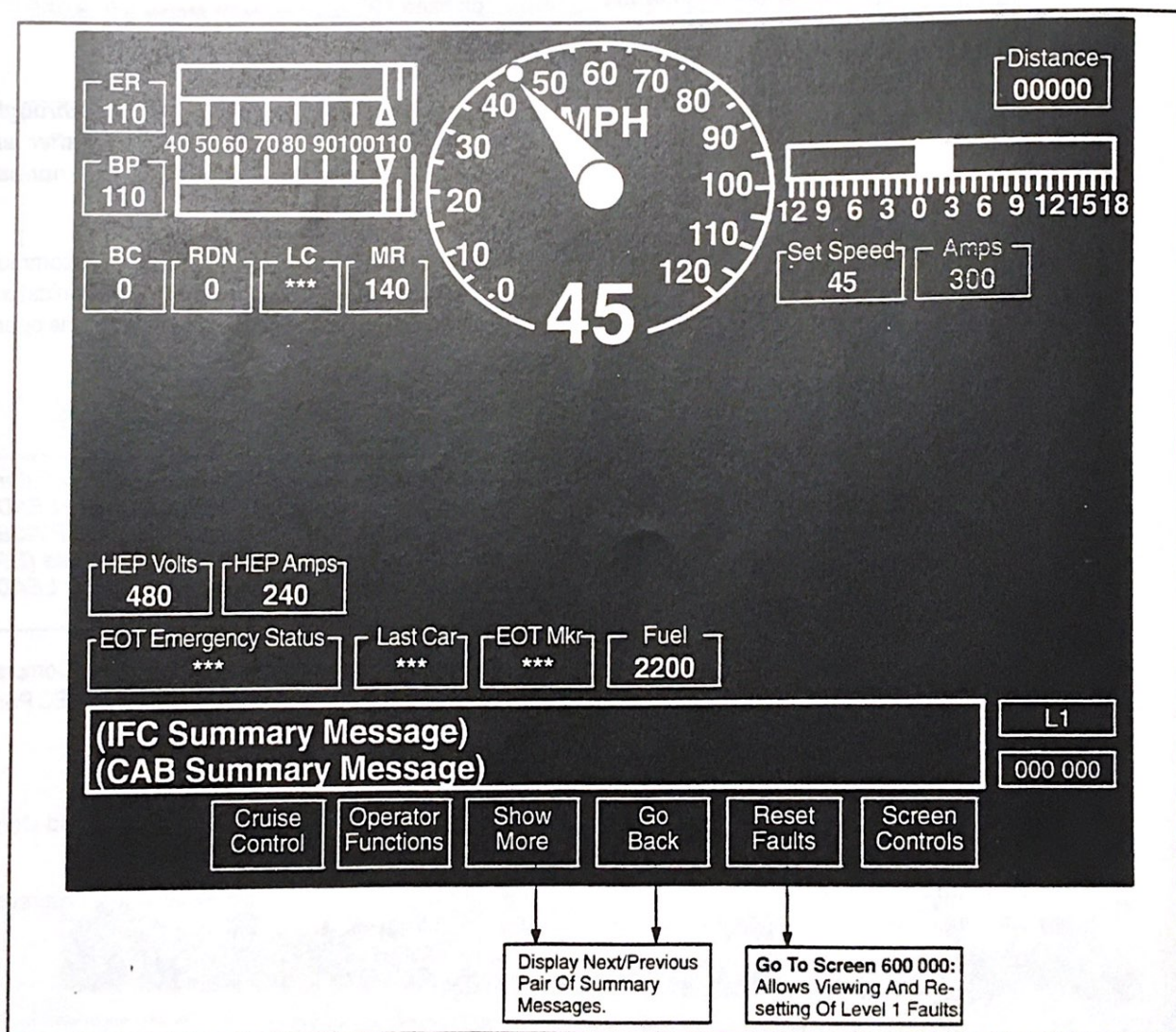


FIG. 73. MAIN OPERATION SCREEN (000 000). E-42791.



# OPERATOR FAULT RESET

## Introduction

**NOTE:** This screen (Fig. 74) will display only the faults that may be reset at LEVEL 1 operation. The faults will be shown in chronological order with the newest shown first. When all faults have been reset, lower Display Line will read "NO MORE ACTIVE FAULTS" for three seconds and then the IFC control will exit to screen 000 000 (Fig. 73).

Operator Fault Reset is a program which gives the operator the ability to review and reset certain IFC and CAB

active faults. Only the active faults that may be reset at Level 1 will be shown. All active faults are displayed in chronological order, newest first. If there are no resettable active faults, operator message line will read either "No IFC Faults At This Level" or "No CAB Faults At This Level," or both.

## Operation

Pressing key position F6, **Reset Faults**, on the Main Operation Screen (screen 000 000, Fig. 73) will display screen 600 000, Fig. 74). The active keys and a brief description of operation are as follows:

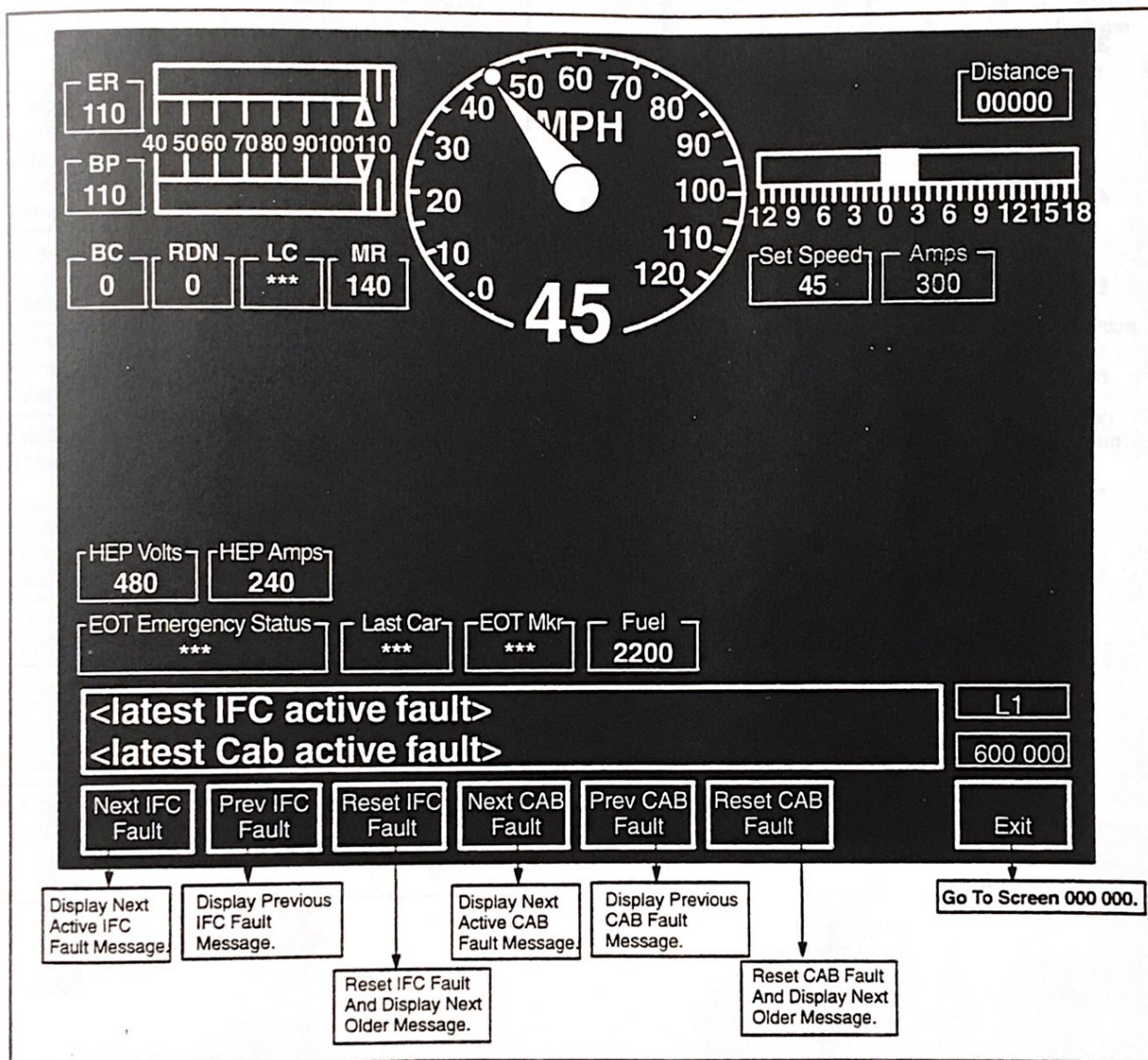


FIG. 74. OPERATOR FAULT RESET SCREEN (600 000). E-42593.



**NOTE:** Upon entering Screen 600 000, the active resettable faults will be shown in chronological order (latest first). If there are no more active faults, the screen will read "No More Active Faults" for three seconds then return to screen 000 000.

1. Pressing key position F1 (**Next IFC Fault**) will display the next active IFC fault message – see Note.
2. Pressing key position F2 (**Prev IFC Fault**) will display the previous active IFC fault message – see Note.
3. Pressing key position F3 (**Reset IFC Fault**) will reset the displayed IFC fault message then display the next oldest active IFC fault message – see Note.
4. Pressing key position F4 (**Next CAB Fault**) will display the next active CAB fault message.
5. Pressing key position F5 (**Prev CAB Fault**) will display the previous active CAB fault message.
6. Pressing key position F6 (**Reset CAB Fault**) will reset the displayed CAB fault message then display the next oldest active CAB fault message.
7. Pressing key position F8 (**Exit**) will return the operator to the Main Operation Screen (000 000).

**NOTE:** The P42-DC Locomotive has four distinct audible indicators located in the Operating Compartment:

1. **Main Alarm Bell** – used for Ground Faults, HEP No Power, etc.
2. **Buzzer** – used for Crew Member signals.
3. **Sonalert** – used for Cab Signal Penalty Brake Application Warning.
4. **Klaxon (yelp)** – used for Alertness Control.

**TABLE 4. AUDIBLE/VISUAL INDICATOR REFERENCE.**

| EVENT                     | INDICATION |        | RESULT                              |
|---------------------------|------------|--------|-------------------------------------|
|                           | AUDIBLE    | VISUAL |                                     |
| GROUND (Propulsion)       | BELL       | YES    | Propulsion Power Off                |
| GROUND (HEP)              | BELL       | YES    | Possible Loss of HEP                |
| WHEELSLIP/SLIDE           | NONE       | YES    | Reduced Propulsion                  |
| DYNAMIC BRAKE OVERLOAD    | BELL       | YES    | Indication Only                     |
| MOTOR CIRCUIT OVERLOAD    | BELL       | YES    | Power Removed From Affected Circuit |
| ALERTNESS CONTROL         | KLAXON     | YES    | Impending Penalty Brake             |
| CAB SIGNAL/IITS           | SONALERT   | NO     | Impending Penalty Brake             |
| POWER - OFF (PCS)         | NONE       | YES    | Propulsion Power Off                |
| OVER-SPEED                | KLAXON     | YES    | Impending Penalty Brake             |
| PARKING BRAKE             | BELL       | YES    | Indication Only                     |
| HOT SUPPORT BEARING       | BELL       | YES    | Indication on IFD & HPDP Only       |
| SIGNAL FROM PASSENGER CAR | BUZZER     | NO     | Indication Only                     |



## LIST OF SUMMARY MESSAGES

Highest  
Priority

BAD Summary Number  
 WAIT  
 WARNING! Axle Problem On Other Loco.  
 WARNING! Hot Axle Bearing On Pass. Car  
 WARNING! Hot Bearing Support On This Loco.  
 WARNING! Air Compressor Does Not Pump  
 WARNING! AC Exhauster Does Not Pump  
 Won't Load: Locked Axle Detected  
 !! Too Hot !! Using HEP May Ruin Engine  
 Automatic Water Drain Disabled  
 SHUTDOWN: Low Oil Pressure  
 SHUTDOWN: Low Water Pressure  
 SHUTDOWN: Crankcase Overpressure  
 SHUTDOWN: Engine Overspeed  
 Won't Crank: Electrical Control Problem  
 Engine Not Running  
 Can't Start HEP. Volts on 480 V TL  
 Please Move Throttle To IDLE  
 480V Trainlines Are Not Made-Up  
 480V TL (LEFT SIDE) Not Made-Up  
 480V TL (RIGHT SIDE) Not Made-Up  
 HEP Start In Process  
 Can't Load Now: Too Much Cycling  
 Can't Charge Battery Now: BRP Cycling  
 No Battery Charge: Elect. Control Prob.  
 Ground In HEP Power Circuit  
 No Battery Charge  
 WARNING! Parking Brake Applied  
 HEP LOAD CONDITIONS  
 Won't Provide Any Head End Power  
 Won't Provide Normal HEP  
 Won't Provide Standby Head End Power  
 Won't Accept Wayside HEP  
 Can't Provide HEP: Side Door(s) Open  
 Won't Battery Jog: Elect. Control Prob.  
 Can't Battery Jog: BKT in Wrong Position  
 Can't Self-Load: REV in Wrong Position  
 Won't Load: Crankcase Overpressure  
 Won't Load: Low Water Pressure  
 Won't Load: Aux. Alternator Field C/O  
 Won't Load: Side Door(s) Open  
 Won't Load: Electrical Control Problem  
 Won't Load: Too Many Speed Sensors C/O  
 Won't Load: Waiting for Aux Alternator  
 Won't Load: Hot Engine  
 Won't Load: Power Circuit Ground  
 Won't Load: Power Circuit Problem  
 Won't Load: Battery Charge Problem  
 Won't Load: Hot Diodes

Won't Load: MU Error  
 Won't Load: Fault Message Stored  
 ISOLATED  
 No Dynamic Brake: Man. Tract. Motor C/O  
 No Dynamic Brake: Auto. Tract. Motor C/O  
 No Dynamic Brake: Elect. Control Prob.  
 No Dynamic Brake: Power Circuit Problem  
 No Dynamic Brake: Fault Message Stored  
 No Blended Brake: Elect. Control Problem  
 Won't Crank: Fault Message Stored  
 Won't Self Load: Fault Message Stored  
 Self-Load: LOAD CONDITIONS  
 Warning: Locked Axle Alarm is Cut Out  
 Load Limited: PLS in Notch 7  
 Load Limited: T/L 13 or T/L 16 Open  
 Load Limited: Low Oil Pressure  
 Load Limited: Low Water Pressure  
 Load Limited: Hot Engine  
 Load Limited: Cold Engine  
 Load Limited: Dirty Engine Air Filter  
 Load Limited: Traction Motors Cut Out  
 Load Limited: Trac. Motor Temp. Protection  
 Load Limited Due To Traction Alternator  
 Load Limited: Power Circuit Ground  
 Load Limited: Electrical Control Problem  
 May Reduce Load: Radiator Fan Cycling  
 May Reduce Load: Radiator Fan Problem  
 Alarm From Other Unit  
 Passenger Car Load Is Not Balanced  
 May Not Provide Trail HEP  
 Fault Log Is Almost Full  
 Spare Summary Message 01  
 Spare Summary Message 02  
 Spare Summary Message 03  
 Spare Summary Message 04  
 Spare Summary Message 05  
 Load Limited: Too Much Power Braking  
 READY - Fault Message Stored  
 READY - Work Report Stored  
 READY

Lowest  
Priority



## SUMMARY MESSAGES RESETS

**NOTE:** The following sections are listed in order of priority found in the LIST OF SUMMARY MESSAGES.

There are approximately 1700 faults which can occur on this locomotive. ALL faults must be acknowledged or reset using the IFD screen unless automatically reset. Some faults may require a reset/check of some device/equipment on the locomotive, in addition to reset using the IFD screen. As an example, fault code 4C1A produces the summary message "Won't Provide Any Head

End Power" (see below). You must first reset the HECB before the fault can be reset using the IFD screen.

Most faults produce multiple summary messages. Observe ALL summary messages associated with a fault when attempting to reset. Some faults will prohibit a reset due to equipment malfunction or damage. In this case the locomotive must be moved to a repair facility.

The table below lists most of the faults which require reset/check of some device/equipment before IFD reset can be accomplished.

**NOTE:** Faults must be reset on IFD as well as following TROUBLESHOOTING section below.

TABLE 5. FAULT RESET.

| <b>WARNING: Electrical Hazard. Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!</b> |              |  |
|--|--------------|--|
| SUMMARY MESSAGE  | FAULT        | REMEDY   |
| BAD Summary Number   |              | Not Applicable – For maintenance employees only  |
| WAIT   |              | Displayed when Battery Charge and Computer Circuit Breaker is turned ON. If IFD screen displays "WAIT" continuously, see <u>IFC Reset</u> section of TROUBLESHOOTING.  |
| Warning! Axle Problem On Other Loco.   |              | Another locomotive in the consist has a locked axle or hot traction motor support bearing. Refer to Summary Message "Won't Load: Locked Axle Detected" and Summary Message "Warning! Hot Support Bearing on This Loco."  |
| Warning! Hot Axle Bearing on Pass. Car   | 4567         | A passenger car in the train has a hot bearing. Follow railroad rules and procedures for hot axle bearings on passenger cars.  |
| Warning! Hot Support Bearing on This Loco.   | 4569         | A hot traction motor support bearing has been detected on this locomotive. Refer to <u>Hot Support Bearing Detection System</u> in the TROUBLESHOOTING section.  |
| Warning! Air Compressor Does Not Pump  | 44E2<br>44EB | Check that air compressor cut-out cock handle is cut-in (Item 1, Fig. 23) to ensure that the compressor magnet valve (Item 3, Fig. 20) is free to operate. Valve handle should be perpendicular with pipe. Continuous reset of these faults can cause air compressor motor damage.   |
| Won't Load: Locked Axle Detected   | 44B3         | Mechanical problem with #1 traction motor, gear box, or axle. Check for locked #1 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #1 traction motor (Item 26, Fig. 12), both located on engine control panel. Before proceeding, make sure #1 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                           | FAULT        | REMEDY   |
|---|--------------|--|
| Won't Load: Locked Axle Detected (Cont'd) | 44B4         | Mechanical problem with #2 traction motor, gear box, or axle. Check for locked #2 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #2 traction motor (Item 27, Fig. 12), both located on engine control panel. Before proceeding, make sure #2 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
|   | 44B5         | Mechanical problem with #3 traction motor, gear box, or axle. Check for locked #3 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #3 traction motor (Item 28, Fig. 12), both located on engine control panel. Before proceeding, make sure #3 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
|   | 44B6         | Mechanical problem with #4 traction motor, gear box, or axle. Check for locked #4 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #4 traction motor (Item 29, Fig. 12), both located on engine control panel. Before proceeding, make sure #4 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
| !!Too Hot!! Using HEP May Ruin Engine     | 49C6         | Continuing the use of HEP may result in permanent engine damage. Fault is associated with HOT ENGINE. See Summary Message "Won't Load: Hot Engine."  |
| SHUTDOWN: Low Oil Pressure                | 4491<br>456B | Check engine oil level (page 53).  |
| SHUTDOWN: Low Water Pressure              | 448E<br>4492 | Check engine cooling water level (Item 21, Fig. 1 and page 55). Add if necessary. For 5 minutes after fault is reset, and engine is restarted, maximum throttle allowed is RUN 2.  |
| SHUTDOWN: Crankcase Overpressure          |              | The crankcase overpressure sensor has detected a high pressure condition in the engine crankcase. Cannot be reset by engine crews.   |
| SHUTDOWN: Engine Overspeed                | 4428         | Reset VIA IFD screen. See <u>Overspeed Engine Shutdown</u> of <b>TROUBLESHOOTING</b> section.  |
| Won't Crank: Electrical Control Problem   | 400D<br>400E | Check for tripped or improperly set-up circuit breakers and switches on engine control panel (see Fig. 12).  |
| Engine Not Running                        |              | Summary Message to tell operator that the diesel engine is not running.  |
| Can't Start HEP. Volts on 480 V TL        |              | Not a Fault. Indicates that HEP cannot be started on this unit because HEP is already being supplied from some other source. See HEP section of this manual for more details.  |
| Please Move Throttle To IDLE              |              | Control system has limited power to the traction motors. See <u>Traction Motor Stall Protection</u> , in <b>OPERATING RESTRICTIONS</b> section.  |
| 480V Trainlines Are Not Made-Up           |              | Not a Fault. Indicates that HEP Trainline Complete is not made up on one or both sides of the train. Cause could be loose or improperly installed 480 VAC jumper cables.   |



TABLE 5. FAULT RESET. (Cont'd)

| <p><b>WARNING: Electrical Hazard. Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!</b></p> |              |   |
|---|--------------|---|
| SUMMARY MESSAGE   | FAULT        | REMEDY  |
| 480V TL (LEFT SIDE) Not Made-Up   |              | Not a Fault. Indicates that HEP Trainline Complete is not made up on the LEFT side (Assistant Engineer's side) of the train. Cause could be loose or improperly installed 480 VAC jumper cables on LEFT side of train. If locomotives other than General Electric are trailing in a multiple unit consist, cause could be loose or improperly installed 480 VAC jumper cables on EITHER side of train.  |
| 480V TL (RIGHT SIDE) Not Made-Up  |              | Not a Fault. Indicates that HEP Trainline Complete is not made up on the RIGHT side (Engineer's side) of the train. Cause could be loose or improperly installed 480 VAC jumper cables on RIGHT side of train. If locomotives other than General Electric are trailing in a multiple unit consist, cause could be loose or improperly installed 480 VAC jumper cables on EITHER side of train.  |
| HEP Start In Process  |              | Not a Fault. Indicates that HEP startup is taking place.  |
| Can't Load Now: Too Much Cycling  |              | Reset VIA IFD screen.   |
| Can't Charge Battery Now: BRP Cycling   |              | Reset VIA IFD screen.   |
| No Battery Charge: Elect. Control Prob.   | 449E         | Turn off cab heat/AC to determine if either are source of fault. Turn cab heat/AC back on if fault cannot be isolated. Battery charger may be defective.  |
| Ground In HEP Power Circuit   |              | Reset VIA IFD screen. If this fault continues within a short time interval in a multiple unit consist, attempt to operate HEP from another unit. Otherwise, short loop between the locomotive(s) and first car, on both sides. Attempt to restart HEP. If fault does not occur problem is likely to be in train; not locomotive.  |
| No Battery Charge   | 441E<br>4420 | Turn off cab heat/AC to determine if either are source of fault. Air dryer could also cause this fault. Try turning off air dryer circuit breaker to determine source. Turn cab heat/AC, air dryer back on if fault cannot be isolated. Battery charger may have a blown fuse.  |
| Warning! Parking Brake Applied  | 42E5         | Check that parking brake valve in operator's cab (Item 4, Fig. 10) is in the "RELEASE" position. Stop and observe brakes to make sure shoes are not against wheels. While stopped, check parking brake cut-out cocks on side of locomotive (one for each truck) (Item 25, Fig. 21). These must be cut-in (handle perpendicular to pipe) for parking brake to release on each truck. If parking brake is released and all wheels rotate freely, reboot the IFC controller by following the procedure in the <u>IFC Reset</u> section of <b>TROUBLESHOOTING</b> . |
| HEP__LOAD__CONDITIONS   |              | Not a Fault. Indicates current HEP load conditions  |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                  | FAULT  | REMEDY   |
|----------------------------------|--|--|
| Won't Provide Any Head End Power | 49C5   | Fault is associated with HOT ENGINE. (See "Won't Load: Hot Engine.") Continuing to use HEP may cause permanent engine damage.  |
|                                  | 4C08   | Head End Transfer Switch HETS (page 47) may be out of position. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Otherwise, open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>Head End Transfer Switch (HETS)</u> in this section. |
|                                  | 4C13<br>4C14<br>4C15   | Long Hood Isolate Switch LIS (page 47) may be out of position. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Otherwise, open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>HEP Lead Isolation Switch (LIS)</u> in this section.  |
|                                  | 4C1A   | Reset HECB (Item 13, Fig. 13) located in electrical cabinet behind assistant engineer.   |
|                                  | 4C1B   | Reset HECB (Item 13, Fig. 13) located in electrical cabinet behind assistant engineer. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. If this fault continues within a short time interval between breaker trips, short loop between the locomotive(s) and first car, on both sides. Attempt to restart HEP. If fault does not occur problem is likely to be in train, not locomotive.  |
|                                  | 4C49<br>4C4A<br>4C4B<br>4C4C<br>4C51<br>4C52<br>4C53<br>4C54 | Reset fault. If this fault continues within a short time interval in a multiple unit consist, attempt to operate HEP from another unit. Otherwise, short loop between the locomotive(s) and first car, on both sides. Attempt to restart HEP. If fault does not occur problem is likely to be in train; not locomotive.  |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                      | FAULT                        | REMEDY   |
|--------------------------------------|------------------------------|--|
| Won't Provide Normal HEP             | 4C05<br>4C06                 | Head End Transfer Switch HETS (page 47) may be out of position. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Otherwise, open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>Head End Transfer Switch (HETS)</u> in this section. |
|                                      | 4C20<br>4C21                 | If one or both Trainline Complete lights are off, Door Interlock Switches (DIS) may not be closed. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed. If DIS is OK, trainline complete problem may exist in train. To isolate problem, short loop between locomotive(s) and first car. Attempt to start HEP. If HEP starts, problem is in train.   |
|                                      | 4C28<br>4C29<br>4C2A<br>4C4C | If in a multiple unit consist, attempt to operate HEP from another unit. Ground is in locomotive, not train.   |
|                                      | 4C4E<br>4C50                 | Too much HEP load. Reduce HEP load from train.   |
|                                      | 4C5B<br>4C5C                 | Diesel engine speed incorrect to provide HEP. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Check fuel sight glass for even flow (Figs. 69 and 71). Check that there is sufficient fuel in fuel tank. Check diesel engine air filters for clogging (Item 25, Fig. 1 and Fig. 45).  |
|                                      | 4C60                         | Diesel engine speed incorrect to provide HEP. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Check fuel sight glass for even flow (Figs. 69 and 71). Check that there is sufficient fuel in fuel tank. Check diesel engine air filters for clogging (Item 25, Fig. 1 and Fig. 45). Possibility of too much HEP load. Reduce HEP load from train.  |
|                                      |                              |  |
| Won't Provide Standby Head End Power | 4C02<br>4C03                 | Head End Transfer Switch HETS (page 47) may be out of position. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Otherwise, open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>Head End Transfer Switch (HETS)</u> in this section. |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                               | FAULT                | REMEDY  |
|---|----------------------|---|
| Won't Provide Standby Head End Power (Cont'd) | 4C25<br>4C26<br>4C27 | If in a multiple unit consist, attempt to operate HEP from another unit. Ground is in locomotive, not train.  |
|   | 4C4D                 | Too much HEP load. Reduce HEP load from train.  |
|   | 4C5D<br>4C5E         | Diesel engine speed incorrect to provide HEP. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Check fuel sight glass for even flow (Figs. 69 and 71). Check that there is sufficient fuel in fuel tank. Check diesel engine air filters for clogging (Item 25, Fig. 1 and Fig. 45).   |
|   | 4C5F                 | Diesel engine speed incorrect to provide HEP. If in a multiple unit consist, attempt to operate HEP from another unit before spending time troubleshooting this unit. Check fuel sight glass for even flow (Figs. 69 and 71). Check that there is sufficient fuel in fuel tank. Check diesel engine air filters for clogging (Item 25, Fig. 1 and Fig. 45). Possibility of too much HEP load. Reduce HEP load from train. |
|   |                      |   |
| Won't Accept Wayside HEP                      |                      | Not a Fault. Indicates that WAYSIDE HEP cannot be started on this unit because HEP is already being supplied from some other source. See <b>HEP</b> section of this manual for more details.  |
| Can't Provide HEP. HEP Door Is Open           |                      | Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed.  |
| Won't Battery Jog: Elect. Control Prob.       |                      | Reset VIA IFD screen.   |
| Can't Battery Jog: BKT in Wrong Position      |                      | Reset VIA IFD screen.   |
| Can't Self-Load: REV in Wrong Position        |                      | Reset VIA IFD screen.   |
| Won't Load: Crankcase Overpressure            |                      | Must NOT be reset by engine crews.  |
| Won't Load: Low Water Pressure                |                      | Check engine cooling water level (Item 21, Fig. 1 and page 55). Add if necessary. If low water pressure continues for approximately 35 seconds, diesel engine will shut down. See summary message "Shutdown: Low Water Pressure."   |
| Won't Load: Aux. Alternator Field C/O         |                      | Not a Fault. Indicates that the BFCO switch (Item 3, Fig. 13) is open.  |
| Won't Load: Side Door Open                    |                      | Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed.  |



TABLE 5. FAULT RESET. (Cont'd)

| <b>WARNING: Electrical Hazard. Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!</b> |  |   |
|--|--|---|
| SUMMARY MESSAGE  | FAULT  | REMEDY  |
| Won't Load: Electrical Control Problem   | 4016<br>4017   | Check for tripped or improperly set-up circuit breakers and switches on engine control panel (Fig. 12).   |
|  | 4415   | Check engine cooling water level (Item 21, Fig. 1 and page 55). Add if necessary.   |
|  | 44C5   | Door Interlock Switches (DIS) may not be closed. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed.   |
|  | 4006<br>4007   | Check locomotive M.U. cables. Unplug between units to isolate problem. May be caused by moving reverser handle during blended braking.  |
|  | 44C8   | Door Interlock Switches (DIS) may not be closed. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed. Auxiliary Alternator will not operate for 11.6 minutes after this fault is logged.  |
|  | 456A   | Check for low lube oil level (Fig. 44).   |
|  | 4864<br>48E6<br>48E7                                 | Braking Switch BKT (page 47) may be out of position. Open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>Braking Switch (BKT)</u> in this section.         |
|  | 48E8<br>48E9   | Reverser REV (page 47) may be out of position. See instructions in <u>Reverser (REV)</u> in this section.   |
|  | 49BB<br>49BC<br>49BD<br>49BE<br>49BF<br>49C0<br>49C1 | Brake Motor Switch BMS (page 47) may be out of position. Open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>Brake Motor Switch (BMS)</u> in this section. |
|  |  | See <u>Motor and Speed Sensor Cut-Out Switches</u> section of <b>TROUBLESHOOTING</b> .  |
| Won't Load: Too Many Speed Sensors C/O   |  |   |
| Won't Load: Waiting for Aux. Alternator  |  | Not a Fault. The Aux. alternator is in the process of starting. Loading is restricted until it is on-line.  |
| Won't Load: Hot Engine   | 442A   | Check engine cooling water level (Item 21, Fig. 1 and page 55). Check engine oil level (page 53). See <u>Cooling System</u> in <b>TROUBLESHOOTING</b> section. Check radiator for debris. If radiator is clogged with debris, center reverser (place in neutral) and move combined power handle to NOTCH 3. Operate Fan Reverse Switch (Item 4, Fig. 13) until debris is cleared.   |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                    | FAULT        | REMEDY   |
|------------------------------------|--------------|--|
| Won't Load: Power Circuit Ground   | 442C<br>4564 | More than 3 ground relays (faults) have occurred in the past 30 minutes. Try cutting out individual traction motors to isolate problem. If any traction motors are cut out, observe axle to determine if wheels rotate freely.   |
|                                    | 4563         | Will automatically reset 15 seconds after fault occurs. If this fault occurs 4 times fault 4564 will be logged. See section with summary message "Won't Load: Power Circuit Ground"  |
| Won't Load: Power Circuit Problem  | 4412         | A fault has been detected in the high voltage control system which prohibits motoring. Open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Press reset button on ABOL (Item 11, Fig. 35 and page 49) located in auxiliary compartment.   |
| Won't Load: Battery Charge Problem | 445B         | Door Interlock Switches (DIS) may not be closed. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed.  |
| Won't Load: Hot Diodes             | 44E5         | Isolate unit and allow sufficient time for rectifier to cool before attempting place unit back "On Line."  |
| Won't Load: MU Error               | 4001<br>4004 | Check locomotive M.U. cables. Unplug between units to isolate problem.   |
| Won't Load: Fault Message Stored   | 4430         | Will automatically reset 15 seconds after fault occurs. If this fault occurs 4 times fault 442C will be logged. See section with Summary Message "Won't Load: Power Circuit Ground."   |
|                                    | 44B9         | Mechanical problem with #1 traction motor, gear box, or axle. Check for locked #1 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #1 traction motor (Item 26, Fig. 12), both located on engine control panel. Before proceeding, make sure #1 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
|                                    | 44BA         | Mechanical problem with #2 traction motor, gear box, or axle. Check for locked #2 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #2 traction motor (Item 27, Fig. 12), both located on engine control panel. Before proceeding, make sure #2 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
|                                    | 44BB         | Mechanical problem with #3 traction motor, gear box, or axle. Check for locked #3 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #3 traction motor (Item 28, Fig. 12), both located on engine control panel. Before proceeding, make sure #3 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                           | FAULT        | REMEDY   |
|---|--------------|--|
| Won't Load: Fault Message Stored (Cont'd) | 44BC         | Mechanical problem with #4 traction motor, gear box, or axle. Check for locked #4 axle. If axle not locked, probable cause is faulty speed sensor. To cut out speed sensor: Cut out Speed Sensor Cut-out switch (Item 30, Fig. 12) and cut out #4 traction motor (Item 29, Fig. 12), both located on engine control panel. Before proceeding, make sure #4 axle rotates freely. <b>Follow railroad procedures for cutting out traction motors.</b> |
| Won't Battery Jog: Fault Message Stored   |              | Reset VIA IFD screen.  |
| ISOLATED                                  |              | Not a Fault. Indicates that the EC switch (Item 19, FIG 12) is in the ISOLATE position.  |
| No Dynamic Brake: Man. Tract. Motor C/O   |              | Not a Fault. Indicates that one or more of the Traction Motor Cut-out switches (Items 26, 27, 28, 29, Fig. 12) have been thrown (cut-out).   |
| No Dynamic Brake: Auto. Tract. Motor C/O  | 4431<br>4443 | Problem with #1 traction motor (possible flashover). #1 traction motor has been automatically cut out.   |
|   | 4432<br>4444 | Problem with #2 traction motor (possible flashover). #2 traction motor has been automatically cut out.   |
|   | 4433<br>4445 | Problem with #3 traction motor (possible flashover). #3 traction motor has been automatically cut out.   |
|   | 4434<br>4446 | Problem with #4 traction motor (possible flashover). #4 traction motor has been automatically cut out.   |
| No Dynamic Brake: Elect. Control Prob.    | 4019<br>401B | Check for tripped or improperly set-up circuit breakers and switches on engine control panel (pages 23 & 24).  |
| No Dynamic Brake: Power Circuit Problem   |              | Reset VIA IFD screen.  |
| No Dynamic Brake: Fault Message Stored    |              | See summary message "Won't Load: Electrical Control Problem" under faults 48E6, 48E7, 48E8, and 48E9.  |
| No Blended Brake: Elect. Control Problem  |              | Automatic Brake Valve handle will control only air brakes. The dynamic brake portion of blended no longer functions (Manual Dynamic still functions). Reset VIA IFD screen.  |
| Won't Crank: Fault Message Stored         |              | Reset VIA IFD screen.  |
| Won't Self-Load: Fault Message Stored     |              | Reset VIA IFD screen.  |
| Self Load: LOAD CONDITIONS                |              | Not Applicable. For Maintenance personnel only   |
| Warning: Locked Axle Alarm is Cut Out     |              | Not a Fault. Indicates that the Locked Axle Alarm Cut-out switch (Item 31, Fig. 12) has been cut out. <b>If Locked Axle Alarm Cut-Out switch is cut out, locked axle audible alarm will not ring, even if a locked axle occurs.</b>  |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                            | FAULT | REMEDY  |
|--|-------|---|
| Load Limited: PLS in Notch 7               |       | Not a Fault. Indicates that the Power Limit Toggle switch (Item 25, Fig. 5) has been moved to the NOTCH 7 position. See page 17 for more details.   |
| Load Limited: T/L 13 or T/L 16 Open        |       | Reset VIA IFD screen.   |
| Load Limited: Low Oil Pressure             | 4414  | Maximum throttle limited to NOTCH 1. Check diesel engine oil level (Fig. 44).   |
| Load Limited: Low Water Pressure           |       | Check engine cooling water level (Item 21, Fig. 1 and page 55). Add if necessary. See <u>Cooling System</u> in <b>TROUBLESHOOTING</b> section. See Summary Message "Shutdown: Low Water Pressure."  |
| Load Limited: Hot Engine                   |       | Indicates that maximum load has been reduced (derated) because of excessive water or oil temperature. Maximum load is adjusted from 100% at 230 F to 50% at 235 F. Check diesel engine cooling water level (page 55). Check engine lube oil level (Fig. 44). See Summary Message "Won't Load: Hot Engine" for temperatures above 235 F. Also see <u>Cooling System</u> in <b>TROUBLESHOOTING</b> section. |
| Load Limited: Cold Engine                  |       | Reset VIA IFD screen. See <u>Cooling System</u> in <b>TROUBLESHOOTING</b> section.  |
| Load Limited: Dirty Engine Air Filter      | 4009  | Check diesel engine air filters (Item 16, Fig. 1) for debris or plugging.   |
| Load Limited: Traction Motors Cut-Out      | 4437  | Problem with #1 traction motor (possible flashover). #1 traction motor has been automatically cut out.  |
|  | 4438  | Problem with #2 traction motor (possible flashover). #2 traction motor has been automatically cut out.  |
|  | 4439  | Problem with #3 traction motor (possible flashover). #3 traction motor has been automatically cut out.  |
|  | 443A  | Problem with #4 traction motor (possible flashover). #4 traction motor has been automatically cut out.  |
| Load Limited: Trac. Motor Temp. Protection |       | Indicates one or more of the tractions motors is operating above its allowable continuous operating temperature. Use same cooling strategy as traction alternator. See <u>Traction Alternator Deration</u> section of <b>TROUBLESHOOTING</b> .  |
| Load Limited Due To Traction Alternator    |       | Indicates that the traction alternator has been derated due to overtemperature. See <u>Traction Alternator Deration</u> section of <b>TROUBLESHOOTING</b> .   |
| Load Limited: Power Circuit Ground         |       | Indicates that a ground is detected in the power circuit. This summary message is displayed and load is limited until ground leakage current either reduces or increases. If ground leakage current increases, all load will be dropped. See summary message "Won't Load: Fault Message Stored", Fault 4430 and "Won't Load: Power Circuit Ground," Fault 4563.   |
| Load Limited: Electrical Control Problem   | 4414  | Maximum throttle limited to NOTCH 1. Check diesel engine oil level (Fig. 44).   |



TABLE 5. FAULT RESET. (Cont'd)

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| SUMMARY MESSAGE                       | FAULT                        | REMEDY  |
|---------------------------------------|------------------------------|---|
| May Reduce Load: Radiator Fan Cycling |                              | Indicates that radiator fan has been cycling on and off too often. When message is displayed, radiator cooling fan will not operate for 15 minutes. After 15 minutes has expired, fan will operate again. During the time that the radiator cooling fan is not operating, the diesel engine could overheat. Check engine cooling water level (Item 21, Fig. 1 and page 55). Add if necessary. Door Interlock Switches (DIS) may not be closed. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed. |
| May Reduce Load: Radiator Fan Problem | 44E6                         | Check auxiliary cab air filters (located below Item 11, Fig. 1 on the right side of the engine compartment) for debris or plugging.   |
| Alarm From Other Unit                 |                              | Indicates that a Fault and/or Alarm has occurred on another unit in the consist. This summary message is accompanied by an alarm bell.  |
| Passenger Car Load Is Not Balanced    |                              | Reset fault. If this fault continues within a short time interval in a multiple unit consist, attempt to operate HEP from another unit. Otherwise, short loop between the locomotive(s) and first car, on both sides. Attempt to restart HEP. If fault does not occur problem is likely to be in train; not locomotive.   |
| May Not Provide Trail HEP             | 4C10<br>4C11<br>4C12<br>4C16 | Long Hood Isolate LIS (page 47) may be out of position. Open BFCO switch (Item 3, Fig. 13) and shut down HEP from any source. Check control air pressure by observing gauge in auxiliary compartment (Item 13, Fig. 35). Control air pressure should be approximately 80 psig. If not, check control air cut-out cock (Item 1, Fig. 26) under hatch in operator's cab (should be cut-in). If Control air is OK, see instructions in <u>HEP Lead Isolation Switch (LIS)</u> in this section.   |
| Fault Log is Almost Full              |                              | Not applicable. For Maintenance personnel only.   |
| Spare Summary Message 01              |                              | Not applicable  |
| Spare Summary Message 02              |                              | Not applicable  |
| Spare Summary Message 03              |                              | Not applicable  |
| Spare Summary Message 04              |                              | Not applicable  |
| Spare Summary Message 05              |                              | Not applicable  |
| Load Limited: Too Much Power Braking  |                              | Control system has limited power to the traction motors. See <u>Power Braking Restriction</u> , in <b>OPERATING RESTRICTIONS</b> section.   |
| READY - Fault Message Stored          |                              | Not a Fault. See Ready Mode, page 99.   |
| READY - Work Report Stored            |                              | Not a Fault. See Ready Mode, page 99.   |
| READY                                 |                              | Not a Fault. See Ready Mode, page 99.   |



## HEP CONTROL PANEL

TABLE 6. HEP CONTROL PANEL LIGHT INDICATIONS.

**WARNING: Electrical Hazard.** Anytime you enter the Auxiliary Compartment or Control Area 9 in the Radiator Compartment, you must open the BFCO switch (Item 3, Fig. 13) located in the center electrical cabinet (CA1). When the BFCO is opened, the IFD screen will display the summary message "Won't Load: Aux. Alternator Field C/O." This switch nullifies any high voltage in the Auxiliary Compartment. In addition, shut down HEP from any source before entering the Auxiliary Compartment!

| IF  | THEN   | REMEDY  |
|---|--|---|
| 480 VAC ON light is ON on this unit before attempting to start HEP.                       | HEP will not start until 480 VAC ON light is turned OFF.   | Refer to <b>HEP</b> section of this manual.   |
| One or Both Trainline complete lights are OFF before attempting to start HEP on this unit | 480 VAC jumper cables not properly made up on train or door interlock switches are open or HEP mode switch is in OFF or WAYSIDE. | Check door interlock switches on all locomotives in consist. Check DIS by making sure Auxiliary Compartment door is completely closed (Fig. 39). Check DIS by making sure air compressor contactor cabinet door (CA9) in right side of Radiator Cab (Fig. 47) is completely closed. Check train for proper 480 VAC jumper installation. |
| One or Both Trainline Complete Lights turn OFF while producing HEP and Train is moving.   | When train speed reduces to below five (5) mph, HEP will shut down.  | Refer to <b>HEP</b> section of this manual.   |
| CB Trip Fault light is ON.  | HEP will not start.  | See "Won't Provide Any Head End Power," Faults 4C1A and 4C1B in Fault Reset Table.  |
| HEP Fault light is ON   | HEP will not start.  | Reset via IFD screen. See Fault Reset Table.  |
| HEP won't start in STANDBY mode.  |  | Check that EC Switch (Item 19, Fig. 12) is in RUN position. Check that 480 VAC ON light is OFF. See <b>HEP</b> section. See Fault Reset Table for other instructions.   |

## MANUAL RESETS

## Ground Cut-Out Switches

Five Ground Relay Cut-Out switches are mounted in Control Area 2 (Items 1–5, Fig. 35).

These are two-pole switches which connect sensing circuits to detect ground leakage current in the following circuits:

1. Propulsion circuit (GRCO1).
2. Excitation supply circuit (GRCO2).
3. Auxiliary motor supply circuit (GRCO3).
4. Battery charging circuit (GRCO4).
5. Head End Power circuits (GRCO5).

One pole of each switch is used to remove the connection from the locomotive frame (chassis ground) to the ground detection circuitry. This is used to remove the "known" ground when performing insulation tests on the locomotive circuits, or to remove the "known" ground when troubleshooting for ground faults.



The other pole of each switch is used to disable control circuits with the switch open.

**NOTE:** The locomotive will not load if any of GRCO1-4 are open. The locomotive will not provide HEP if GRCO5 is open.

Only the propulsion circuit ground detector will derate locomotive performance based on ground leakage. Propulsion buss voltage is reduced according to the amount of ground leakage current as follows:

| Ground Current Leakage (amperes) |               | Result  |
|----------------------------------|---------------|---|
| Motoring or Self-Load            | Dynamic Brake |   |
| 0 to 1/2                         | 0 to 1/4      | Causes no deration.   |
| 1/2 to 1                         | 1/4 to 1/2    | Is range which will derate propulsion buss voltage from no deration at 1/4 amp to full deration at 1/2 amp. |
| Above 1                          | Above 1/2     | Is considered a "solid" ground fault. Power is reduced to zero.   |

The other ground leakage detectors will not derate locomotive performance, but when grounds are detected, alarms will be sounded and faults will be logged on the IFD screen.

### Motor and Speed Sensor Cut-Out Switches

**NOTE:** Under emergency conditions, the locomotive may be operated for a short period of time with one or more traction motors cut-out. Refer to Railroad Rules for specific details of operation.

Traction motors can be cut out manually or automatically. Manual cut out is done with individual Motor Cut-Out switches on the EC panel (Items 26-29, Fig. 12). A message will appear in the Summary Message Area on the IFD Display Screen when a motor is cut out. Slide protection is maintained on traction motors which are cut out as long as the speed sensor cut-out switch has not been cut out. When the speed sensor cut-out switch is cut out, all traction motors which are cut out lose wheel slide protection. If a fault condition such as excessive current or too great a rate of change of current (Motor Flashover) is detected, automatic cut out is done by the microcomputer control.

**CAUTION:** It is recommended that motors only be manually cut out when the Engine Control switch is in START or ISOLATE position (unit isolated) and the Combined Power Handle is in IDLE.

**NOTE:** Speed sensors do not need to be cut out on cut out motors. When the Motor Speed Sensor switch (Item 30, Fig. 12) is in the CUT-OUT position, the speed signals from the speed sensors on motors which are cut out are ignored and wheel slip/slide and locked axle protection will not be available for the cut-out motor(s).

When a motor or motors are cut out, total power available for traction is adjusted as follows:

| Motors Cut-Out | Horsepower Available for Input for Traction |
|----------------|---|
| All IN         | Full HP                                     |
| 1 Out          | See Note 1                                  |
| 2 Out          | See Note 1                                  |
| 3 Out          | See Notes 1 and 2                           |
| 4 Out          | See Notes 1 and 2                           |

**NOTE 1:** Horsepower available for input for traction is limited to 1025 horsepower per each traction motor CUT IN.

**NOTE 2:** Speed sensor inputs from at least two traction motors are required for locomotive to load.

**NOTE:** If any motor is cut out on a locomotive, Dynamic Braking and Self-Load on that locomotive are cut out.

**CAUTION:** If the slip/axle warn light is lit continuously, STOP locomotive and inspect ALL wheels in the locomotive consist to ensure they are rotating freely.

The Speed Sensor cut-out switch (Item 30, Fig. 12) cuts out the Speed Sensor signal on all traction motors that are cut out. This switch is only to be used to cut out faulty sensors; however, ensure that the sensor is at fault and not that it is indicating a locked axle or excessive wheel slip, etc. Locked Axle protection is lost if the speed sensor is cut out.



**NOTE: Locomotive will not load with faulty speed sensor cut-in.**

The traction motor speed sensor will only be cut out (even if speed sensor switch has been thrown) if the motor cut-out switch has also been thrown. Fig.75 shows the speed sensor cut-out switch in the cut out position. The no. 1-4 traction motor cut-out switches are in the cut-in position. Although the speed sensor switch is cut out, no traction motor speed sensor is cut out.

Therefore, the only way to cut out a defective speed sensor is to cut out the traction motor with the defective sensor as well as the speed sensor cut-out switch. This is a safety feature to ensure that wheel slip protection is not lost. Fig. 76 shows the no. 1 traction motor speed sensor properly cut out.

**NOTE: A minimum of two motor speed sensors must be operating for the unit to load. Also, a message will appear in the Summary Message Area on the IFD Function Screen when this switch is opened.**

### Wheel Slip/Slide System in Dynamic/Blended Braking

**NOTE: A locked axle or motor overspeed will cause the computer to drop motor power to zero and indicate a trainlined wheel slip. Power is returned once the condition is corrected.**

In dynamic and blended braking, the amount of correction is determined by the amount of slide and is accomplished in several stages:

#### Stage 1 – Sand (Dynamic Braking)

Automatically apply sand to the leading axles on this locomotive if a small difference in motor speeds is detected. Sanding continues for three seconds after the slide is corrected.

#### Stage 2 – Small Power Reduction (Dynamic Braking)

When the Stage 1 limit is exceeded, a small power reduction goes into effect and sanding continues.

#### Stage 3 – Moderate Power Reduction (Dynamic Braking)

When Stage 2 limit of wheelslip is exceeded, a moderate power reduction goes into effect and sanding continues.

#### Stage 4 – Complete Power Removal (Dynamic Braking)

If a large difference in wheel speeds is detected, a quick power output removal accompanied by a trainlined wheelslip indication results.

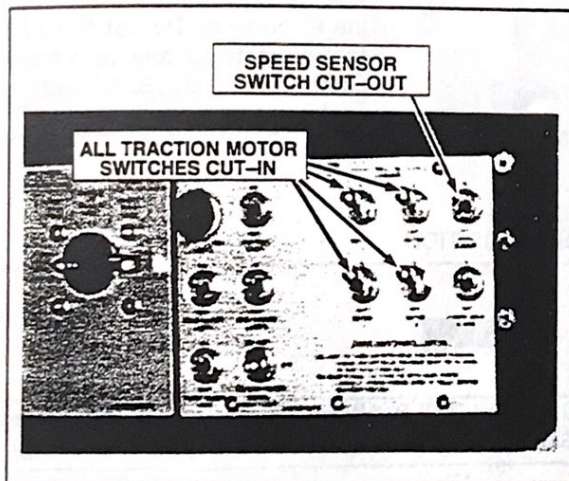


FIG. 75. TRACTION MOTOR SPEED SENSORS CUT-IN. E-42795.

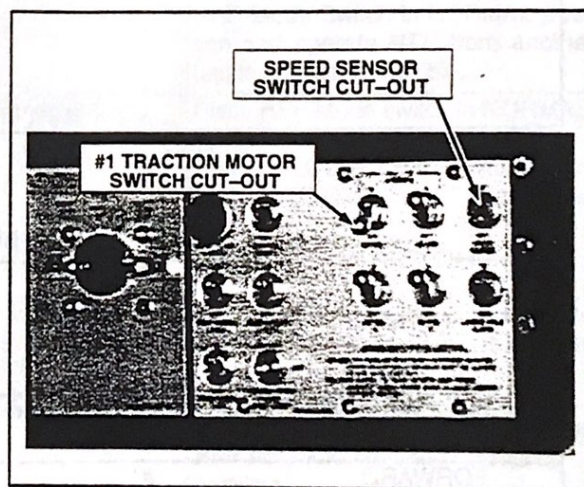


FIG. 76. NO. 1 TRACTION MOTOR SPEED SENSOR CUT-OUT. E-42796.



## Reverser (REV)

**WARNING:** High voltage is present in the auxiliary compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and SHUT DOWN HEP.

## Faults

1. Fault 4865 – REV has bad position feedback when should be FORWARD or REVERSE.
2. Fault 48E8 – REV has REVERSE feedback when commanded to FORWARD.
3. Fault 48E9 – REV has FORWARD feedback when commanded to REVERSE.

## Reset Procedure




**CAUTION:** Keep Clear of Moving Parts.

1. Turn ON Engine Run, Generator Field and Control circuit breakers (Items 18, 19, 20, Fig. 5).
2. Turn ON Local Control circuit breaker (LCCB) (Item 17, Fig. 12).
3. Move Combined Power Handle to IDLE.
4. Slowly move Reverser handle back and forth to FORWARD and REVERSE positions.
5. Observe that REV moves from #1 position to #2 position and back as indicated by the pointer on front of REV (Fig. 36) (#1 POSITION = FORWARD; #2 POSITION = REVERSE).
6. Refer to Table 7 for troubleshooting.

TABLE 7. REVERSER TROUBLESHOOTING.

| IF  | THEN   | REMEDY   |
|---|--|--|
| REV moves between #1 and #2 positions.        | Probable cause is defective position indicators. | Attempt to reset fault using IFD screen.   |
| REV does not move or moves to wrong position. | See Table 8 below for proper REV position.       | Open Local Control circuit breaker (LCCB). Using a large flat head screwdriver, turn the manual operating shaft (Fig. 36) (approximately 30 rotations) to the required position (Clockwise will move the REV pointer toward the #2 position; Counter clockwise will move the REV pointer toward the #1 position). <b>Do not force REV, foreign material may be in moving parts.</b> Turn on LCCB. Attempt to reset fault using IFD screen. |

TABLE 8. REVERSER POSITION.

| ← FORWARD                          |  |  |  |
|------------------------------------|---|--|---|
| Lead Unit Reverser Handle Position | Lead Unit REV Position  | Trailing Unit REV Position (Short Hood Leading)                                      | Trailing Unit REV Position (Long Hood Leading)  |
| FORWARD                            | #1  | #1   | #2  |
| REVERSE                            | #2  | #2   | #1  |



## Head End Transfer Switch (HETS)

**WARNING:** High voltage is present in the auxiliary compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and SHUT DOWN HEP.

## Faults

1. Fault 4C02 – HETS has no position feedback when commanded to STANDBY position.
2. Fault 4C03 – HETS has NORMAL feedback when it should have STANDBY.
3. Fault 4C05 – HETS has no position feedback when commanded to NORMAL position.
4. Fault 4C06 – HETS has STANDBY feedback when it should have NORMAL.
5. Fault 4C08 – HETS has position feedback from both NORMAL and STANDBY.

## Reset Procedure

**CAUTION:** Keep Clear of Moving Parts.

1. Turn ON Engine Run and Control circuit breakers (Items 18, 20, Fig. 5).
2. Turn ON Local Control circuit breaker (LCCB) (Item 17, Fig. 12).
3. Place Reverser handle in CENTER position.
4. Move HEP Mode switch (Item 1, Fig. 57) to NORMAL.
5. Observe that HETS starwheel (Fig. 37) is in the RIGHT position.
6. Move HEP Mode switch to STANDBY.
7. Observe that HETS starwheel is in the LEFT position.

**NOTE:** Left Position = STANDBY; Right Position = NORMAL.

6. Refer to Table 9 for troubleshooting.

TABLE 9. HEAD END TRANSFER SWITCH TROUBLESHOOTING.

| IF   | THEN   | REMEDY  |
|--|--|---|
| HETS Starwheel moves to correct positions.               | Probable cause is defective position indicators. | Attempt to reset fault using IFD screen. If fault occurs again, place HEP Mode Switch in NORMAL position and operate HEP from another unit in consist, if possible.   |
| HETS Starwheel does not move or moves to wrong position. | HETS requires manual movement.                   | Place HEP Mode switch in NORMAL position. Open Local Control Circuit Breaker (LCCB). Insert manual operating bar (Fig. 35) in HETS starwheel and move to NORMAL (RIGHT) <b>Do not force HETS, foreign material may be in moving parts. Be sure to remove manual lever from starwheel.</b> This should allow HEP to be produced on NORMAL mode. Turn on LCCB. Attempt to reset fault using IFD. If fault occurs again, operate HEP from another unit in consist if possible. |



## HEP Lead Isolation Switch (LIS)

**WARNING:** High voltage is present in the auxiliary compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and SHUT DOWN HEP.

### Faults

1. Fault 4C10 – LIS has no position feedback when commanded to TRAIL position.
2. Fault 4C11 – LIS has LEAD feedback when it should have TRAIL.
3. Fault 4C12 – LIS has LEAD and TRAIL feedback when commanded to TRAIL position.
4. Fault 4C13 – LIS has no position feedback when commanded to LEAD position.
5. Fault 4C14 – LIS has TRAIL feedback when it should have LEAD.
6. Fault 4C15 – LIS has LEAD and TRAIL feedback when commanded to LEAD position.
7. Fault 4C16 – LIS has LEAD and TRAIL feedback when not commanded to either.

### Reset Procedure

**CAUTION:** Keep Clear of Moving Parts.

1. Turn ON Engine Run and Control circuit breakers (Items 18, 20, Fig. 5).
2. Turn ON Local Control circuit breaker (LCCB) (Item 17, Fig. 12).
3. Place Reverser handle in CENTER position.
4. Move Locomotive Position switch (Item 2, Fig. 57) to LEAD.
5. Observe that LIS starwheel (Fig. 37) is in the LEFT position.
6. Move Locomotive Position switch to TRAIL.
7. Observe that LIS starwheel is in the RIGHT position.

**NOTE:** Left Position = LEAD; Right Position = TRAIL.

8. Refer to Table 10 for troubleshooting.

**TABLE 10. LEAD ISOLATION SWITCH TROUBLESHOOTING.**

| IF  | THEN   | REMEDY   |
|---|--|--|
| LIS Starwheel moves to correct positions.               | Probable cause is defective position indicators. | Attempt to reset fault using IFD screen. If fault occurs again, operate HEP from another unit in consist, if possible.   |
| LIS Starwheel does not move or moves to wrong position. | LIS requires manual movement.                    | Place Locomotive Position switch in desired position. Open Local Control Circuit Breaker (LCCB). Insert manual operating bar (Fig. 35) in LIS starwheel and move to position which corresponds to Locomotive Position switch (LEAD = LEFT; TRAIL = RIGHT). <b>Do not force LIS, foreign material may be in moving parts. Be sure to remove manual lever from starwheel.</b> Turn on LCCB. Attempt to reset fault using IFD. If fault occurs again, operate HEP from another unit in consist if possible. |



## Brake Motor Switch (BMS)

**WARNING:** High voltage is present in the auxiliary compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and SHUT DOWN HEP.

### Faults

1. Fault 49BB – BMS has no position feedback when commanded to MOTOR.
2. Fault 49BC – BMS has SELFLOAD feedback when commanded to MOTOR.
3. Fault 49BD – BMS has MOTOR and SELFLOAD feedback when commanded to MOTOR.
4. Fault 49BE – BMS has BRAKE feedback when commanded to MOTOR.
5. Fault 49BF – BMS has BRAKE and SELFLOAD feedback when commanded to MOTOR.

6. Fault 49C0 – BMS has BRAKE and MOTOR feedback when commanded to MOTOR.
7. Fault 49C1 – BMS has BRAKE, MOTOR and SELFLOAD when commanded to MOTOR.

### Reset Procedure

**CAUTION:** Keep Clear of Moving Parts.

1. Turn ON Engine Run, Generator Field, and Control circuit breakers (Items 18, 19, 20, Fig. 5).
2. Turn ON Local Control circuit breaker (LCCB) (Item 17, Fig. 12).
3. Place Reverser handle in FORWARD position.
4. Place EC switch (Item 19, Fig. 12) in RUN position.
5. Move Combined Power handle to IDLE.
6. Observe position of BMS starwheel (Fig. 37).

**NOTE:** Left Position = BRAKE; Center Position = MOTORING; Right Position = SELF LOAD.

7. Refer to Table 11 for troubleshooting.

TABLE 11. BRAKE MOTOR SWITCH TROUBLESHOOTING.

| IF                                 | THEN   | REMEDY  |
|------------------------------------|--|---|
| BMS is in CENTER position.         | Probable cause is defective position indicators. | Attempt to reset fault using IFD screen.  |
| BMS Starwheel is in RIGHT position | BMS is stuck in SELFLOAD position.               | Open Local Control Circuit Breaker (LCCB). Insert manual operating bar (Fig. 35) in BMS starwheel and move out of SELFLOAD (RIGHT) position to MOTORING (CENTER). <b>Do not force BMS, foreign material may be in moving parts. Be sure to remove manual lever from starwheel.</b> Turn on LCCB. Attempt to reset fault using IFD screen. This should allow the locomotive to load in MOTORING. |
| BMS Starwheel is in LEFT position  | BMS is stuck in BRAKE position.                  | Open Local Control Circuit Breaker (LCCB). Insert manual operating bar (Fig. 35) in BMS starwheel and move out of BRAKE (LEFT) position to MOTORING (CENTER). <b>Do not force BMS, foreign material may be in moving parts. Be sure to remove manual lever from starwheel.</b> Turn on LCCB. Attempt to reset fault using IFD screen. This should allow the locomotive to load in MOTORING.     |



## Braking Switch (BKT)

**WARNING:** High voltage is present in the auxiliary compartment. When the door to this compartment is opened, the Door Interlock Switch (DIS) will trip causing the unit to drop power. As a safety precaution, before entering this compartment, open the Auxiliary Alternator Cut-Out switch (BFCO) located inside Control Area 1 and **SHUT DOWN HEP.**

### Faults

1. Fault 4864 – BKT has bad position feedback when should be MOTORING or BRAKING.
2. Fault 48E6 – BKT has BRAKE feedback when it should be MOTORING.
3. Fault 48E7 – BKT has MOTORING feedback when it should be BRAKE.

### Reset Procedure

**CAUTION:** Keep Clear of Moving Parts.

1. Turn ON Engine Run, Generator Field, and Control circuit breakers (Items 18, 19, 20, Fig. 5).
2. Turn ON Local Control circuit breaker (LCCB) (Item 17, Fig. 12).
3. Place Reverser handle in FORWARD position.
4. Place EC switch (Item 19, Fig. 12) in RUN position.
5. Move Combined Power handle to IDLE.
6. Observe position of BKT starwheel (Fig. 37).

**NOTE:** Left Position = BRAKE; Right Position = MOTORING.

7. Refer to Table 12 for troubleshooting.

**TABLE 12. BRAKING SWITCH TROUBLESHOOTING.**

| IF                        | THEN   | REMEDY   |
|---------------------------|--|--|
| BKT is in RIGHT position. | Probable cause is defective position indicators. | Attempt to reset fault using IFD screen.   |
| BKT is in LEFT position.  | BKT is stuck in BRAKE position.                  | Open Local Control Circuit Breaker (LCCB). Insert manual operating bar (Fig. 35) in BKT starwheel and move out of BRAKE (LEFT) position to MOTORING (RIGHT). <b>Do not force BKT, foreign material may be in moving parts. Be sure to remove manual lever from starwheel.</b> Turn on LCCB. Attempt to reset fault using IFD screen. This should allow the locomotive to load in MOTORING. |

## Hot Support Bearing Detection System

**CAUTION:** Always follow Railroad Rules and Instructions for hot axle or support bearing.

### System Components

1. Hot Support Bearing Detection Panel (Fig. 77)
2. Eight (8) traction motor support bearing sensors
3. Locomotive IFC and IFD screens

### Alarms

1. **Hot Bearing Alarm** – Continuous alarm above 10 mph. Alarm will automatically silence after 30 seconds and below 10 mph.
  - a. Alarm Hot bearing indicator (Red) is on. Bearing position indicator (Red) is flashing. To silence alarm, push Alarm Reset.
  - b. Alarm Hot bearing indicator (Red) is off. Bearing position indicator (Red) is on. Resets automatically when bearing temperature returns to normal.



2. **System Failure Alarm** – Alarm will automatically silence after 30 seconds. System failure indicator (Yellow) is on. To reset push and release system reset. If indication returns, replace detector box.
3. **Sensor Failure Alarm** – Alarm will automatically silence after 30 seconds. One or more bearing position indicators (Yellow) are on indicating a sensor failure. To reset first push sequence test, then push system reset. Indication will extinguish if problem has been corrected.

### Resets

1. If a hot traction motor support bearing is detected by the detector box, the locomotive operator will see the summary message "Warning! Hot Support Bearing On This Loco." on the IFD screen. An audio alarm will also sound.
2. When a hot traction motor support bearing is detected, stop the locomotive.

**NOTE: Inspect the appropriate traction motor support bearing in accordance with Railroad Rules and Regulations.**

3. To determine which support bearing is hot, observe the LED's on the detector box to see which is lit and flashing red.
4. Upon inspection, if nothing is found to indicate a failed support bearing, press the "Push to Reset" button located at the bottom of the detector box (Item 16, Fig. 13).

**NOTE: After pressing the "Push to Reset" button located on the detector box, the LED which indicated the hot support bearing, will stop flashing and remain lit. The "Alarm Hot Bearing" light will also turn off.**

5. Reset the fault on the IFD screen.

**NOTE: Proceed according to Railroad Rules and Instructions for hot support bearing.**

### System Test

Pushing the system test button will initiate an internal test sequence designed to verify proper operation of the box as well as the input and output devices. Once started the test function will run automatically for about one minute.

## ALARMS, SAFEGUARDS, POWER DERATIONS AND SHUTDOWNS

### Traction Alternator Deration

The traction alternator is equipped with thermal sensors to protect it from overheating. In event the alternator begins to overheat, the locomotive is derated (traction alternator output is reduced). The IFD screen will display a summary message "Load Limited due to Traction Alternator". If the alternator continues to increase in temperature, locomotive is further derated. This deration can continue until locomotive loads very little.

This deration is NOT permanent. If the alternator is cooled, the locomotive will load again. The deration is proportional to the temperature of the traction alternator.

If the locomotive derates to the point where it will not load enough to move the train (stalled), the following cooling procedure will cool the alternator, allowing continued operation:

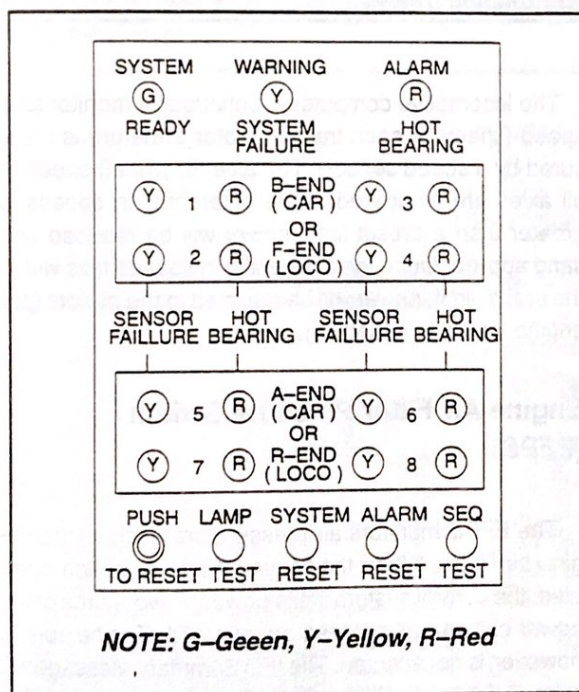


FIG. 77. HOT SUPPORT BEARING DETECTION PANEL. E-42785.



1. Apply sufficient air brakes to secure train and locomotives.
2. Center reverser.
3. Run engine in notch 8.
4. Wait about ten (10) minutes while alternator cools.
5. Return throttle to idle.
6. Proceed according to applicable operating rules.

### Barring-Over Switch

A Barring-Over switch (Fig. 78) is located under the diesel engine barring-over access cover. This switch prevents the engine from being cranked if the cover is removed.

### Emergency Sanding

Emergency sanding is automatically applied in FORWARD and REVERSE directions during all Emergency brake applications for a sufficient time to stop the train (normally 30 seconds). In multiple-unit operation, emergency sanding is applied to all units equipped with pneumatic or electro-pneumatic sanding equipment.

**NOTE:** Emergency sanding is cut out when the Reverser handle is in the neutral position.

**NOTE:** To test sander operation, generator field circuit breaker must be ON and reverser in FORWARD or REVERSE.

### Overspeed – Engine Shutdown

**NOTE:** A diesel engine with EFI is not equipped with an overspeed governor; the functions of the overspeed governor are provided by a solid-state controller. A diesel engine with EFI is not equipped with mechanical fuel linkage; the functions of the fuel linkage are provided by

*the solid-state controller and the electrical solenoids on the fuel pumps. After an overspeed shutdown on an EFI equipped unit, simply reset the fault on the IFD Display Screen and allow the fuel pump motor to cycle OFF – the control does the rest.*

**CAUTION:** During freezing weather, protect the engine cooling system according to railroad instructions.

### Power Limit Switch

When the Power Limit switch (Item 22, Fig. 5) is closed (NOTCH 7), Engine RPM is limited to Notch 7 and Maximum Power is limited to Notch 7 **on this locomotive only.**

### Wheelslip

**CAUTION:** If the slip/axle warn light is lit continuously, STOP locomotive and inspect ALL wheels in the locomotive consist to ensure they are rotating freely.

The locomotive computers continuously monitor axle speed (speed of each traction motor armature is measured by a speed sensor). The axle (or wheel) speed of all axles are compared. If the differential in speeds is greater than a preset limit, power will be reduced and sand applied. Once the differential in speeds falls within the preset limit, power will be returned to the motors (per engine load rate schedule).

### Engine Air Filter Pressure Switch (EFPS)

The EFPS monitors air pressure drop across the engine air filters. When the Engine Air Filter switch operates, the control system limits power to two-thirds of the power call and all notches are affected. Engine speed, however, is not affected. The IFD Summary Message will read "LOAD LIMITED: Dirty Engine Air Filter". The switch is mounted on the wall between the Engine Compartment and the Radiator Compartment.

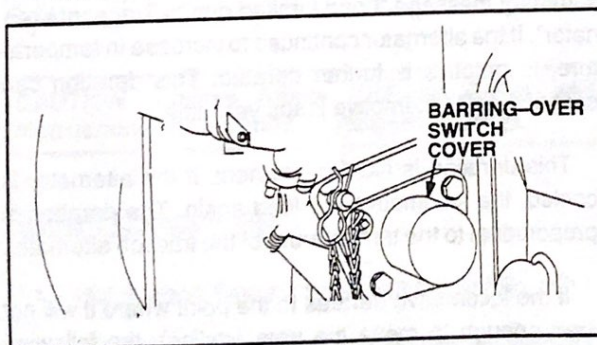


FIG. 78. ENGINE BARRING-OVER SWITCH.  
E-41286.



## STARTING SYSTEM

### Battery Protector System

This locomotive is supplied with a battery protector system. The system operates automatically, when the Battery Switch (Item 18, Fig. 13) is closed and the charger is not operating, to disconnect the battery (Item 47, Fig. 1) from all locomotive systems except: the Cab Signal devices, the radio, the EFI equipment and the Marker Lights. The NBCL NO CHG (No Battery Charge) indicator light on the EC Panel (Item 32, Fig. 12) will light.

**NOTE: A manual override feature (15-minute timer) is provided for locomotive operation. This Battery Connect pushbutton (Item 33, Fig. 12) may be reset repeatedly.**

### Battery Charging

The P42-DC locomotive is equipped with two (2) battery chargers. One charger uses current from the auxiliary alternator when the diesel engine is running. The other is a redundant charger that operates by using current from the HEP system **when HEP is being produced**.

In the event that the locomotive batteries become discharged while attempting to start the diesel engine, the redundant battery charger will charge the batteries from the HEP system.

After batteries become discharged, allow approximately 30 minutes charging time from the HEP system before attempting to restart the diesel engine.

## FUEL SYSTEM

The locomotive fuel tank is divided into four separate compartments. The fuel tank on each side of the locomotive is divided into two compartments (front and rear). Each compartment has a Supply (Item 1, Fig.79) and Return (Item 2, Fig.79) shutoff valve. These valves **must be open** during normal operation. See Fig. 40 for fuel oil piping diagram.

### Fuel Tank Sight Glasses

Fuel-Oil Sight Glasses – Mounted in the sides of the fuel tanks (Item 3, Fig.79) to indicate the level of fuel in the tanks. Top glass (per tank) indicates approximately 500 gallons, second glass indicates approximately 315 gallons, third glass approximately 150 gallons and bottom glass approximately 30 gallons.

**NOTE: When fuel is only visible in each of the four bottom sight glasses, the unit must be refueled.**

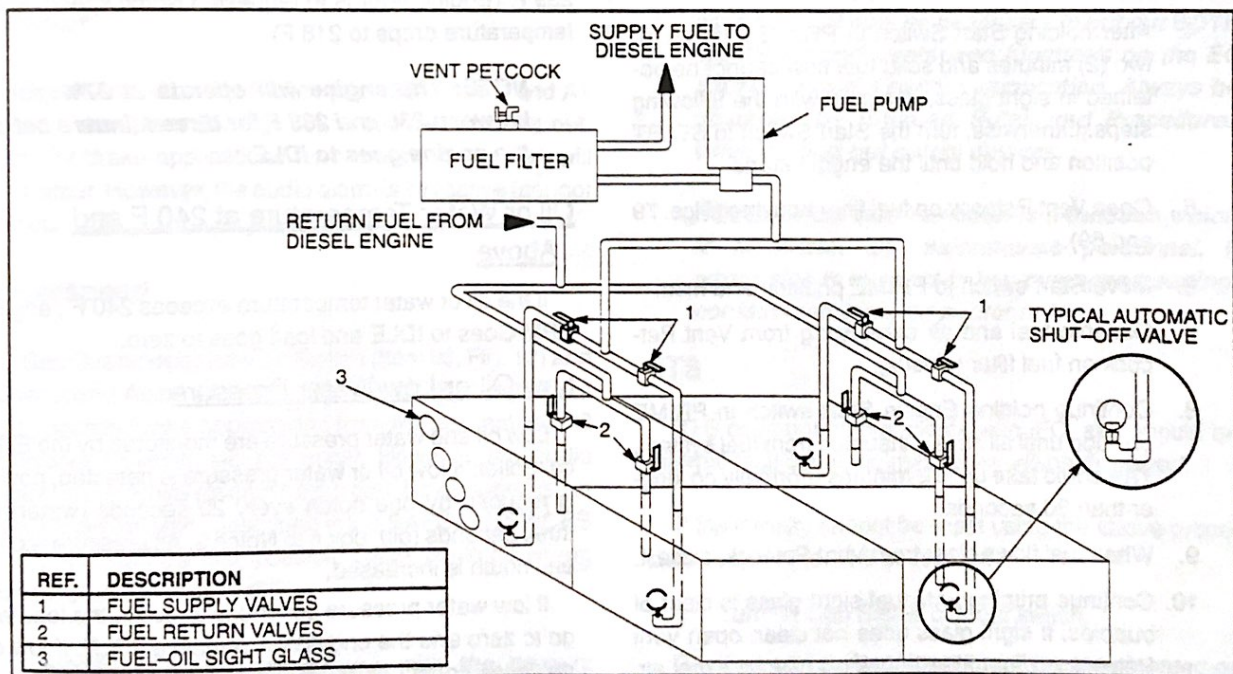


FIG. 79. FUEL TRANSFER SYSTEM. E-42784.



## Fuel Tank Transfer

### Damage to Tank

If one of the compartments is leaking, proceed as follows (Fig. 79):

1. Ensure the other compartments have room to accept the fuel from the leaking compartment (see Fuel Tank Sight Glasses above to calculate).
2. Close the Return valve to the leaking compartment (handle perpendicular to pipe).
3. Ensure fuel pump is running. The transfer rate is approximately 7 gallons per minute.
4. As soon as the leaking compartment is empty, close the Supply valve to prevent fuel from siphoning back into it.

### Unit Runs Out of Fuel

1. Fill unit with fuel.
2. Follow steps 1–10 of Starting Diesel Engine in **ENGINE STARTING/SHUTDOWN** section.
3. At the Start Station (Fig. 70), located near the engine (Fig. 69), turn the Start switch to the PRIME position. Hold until solid fuel flow with no bubbles shows in the sight glass (Fig. 71) and fuel pressure gauge shows approximately 50–55 psig. This could take up to two (2) minutes.
4. After holding Start Switch in PRIME position for two (2) minutes and solid fuel flow cannot be obtained in sight glass, continue with the following steps. Otherwise, turn the Start Switch to START position and hold until the engine starts.
5. Open Vent Petcock on fuel filter housing (Figs. 79 and 69).
6. Move Start switch to PRIME position and hold.
7. Observe fuel and air exhausting from Vent Petcock on fuel filter housing.
8. Continue holding Engine Start switch in PRIME position until all air is exhausted from fuel system. This could take up to 2 minutes (normally no longer than 30 seconds).
9. When fuel flows clear from Vent Petcock, close it.
10. Continue priming until fuel sight glass is clear of bubbles. If sight glass does not clear, open Vent Petcock on fuel filter housing again to expel air. Close Vent Petcock when air is expelled.

11. Repeat steps as necessary until fuel flows clear in fuel sight glass. Fuel pressure as indicated on gauge (Fig. 70) should be 50–55 psig.

12. Turn the Start Switch to START position and hold until the engine starts.

## COOLING SYSTEM

### Oil And Water Temperature And Pressure

Horsepower and/or engine speed will be altered if one of the following conditions exist:

#### Cold Engine

In order to protect a cold engine from rapid warm up, restrictions are places on engine load and speed until engine temperature has reached 140 F (60 C) or higher for more than three minutes. Also, to keep engine operating temperatures within certain limits, engine speed will be altered when temperature drops below certain limits.

#### Hot Engine

### Oil or Water Temperature at 230 to 239 F

Engine RPM goes to Notch 8 and power is derated from no deration at 230 F to full deration (50% power) at 235 F. (Engine returns to requested Notch speed when temperature drops to 218 F)

**NOTE: The engine will operate at 37% power between 236 and 239 F for three minutes before the engine goes to IDLE.**

### Oil or Water Temperature at 240 F and Above

If the oil or water temperature exceeds 240 F, engine RPM Goes to IDLE and load goes to zero.

### Low Oil or Low Water Pressure

Low oil and water pressure are monitored by the EGU controller. If low oil or water pressure is detected, power is reduced by one notch every 20 seconds (water) or three seconds (oil), down to Notch 2. As pressure recovers, notch is increased.

If low water pressure continues to occur, the load will go to zero and the engine will remain at IDLE. If low oil pressure continues to occur, the engine will be shut down.



## SAFETY EQUIPMENT

**NOTE:** Always be governed by Railroad Rules and Procedures when cutting out safety devices.

### Cab Signal

Cab signal communicates with IFC, and should an internal fault occur, fault message will be displayed. Refer to Table 13 for troubleshooting.

**TABLE 13. CAB SIGNAL TROUBLESHOOTING.**

| IF   | THEN   | REMEDY   |
|--|--|--|
| Zero Speed Light ON, penalty occurs immediately upon moving. | Defective speed pickup   | Cutout Cab Signal Switch on Engine Control Panel   |
| Cab Signal CUTOUT Light ON                                   | Aspect Panel not set for host railroad or cut out switch on EC Panel                                     | Select host railroad                               |
| VZ (blue) light stays on when moving.                        | Speed signal failure   | Report to railroad per operating rules.            |
| Aspect Panel Dark  | Aspect Panel set for CUTOUT<br>Cab Signal Circuit Breaker OFF<br>Cab Signal Transfer Switch set for IITS | Select host railroad<br>Reset<br>Select Cab Signal |

### Alerter

See Alerter Cut-Out Switch (Item 35, Fig. 12) and Alerter Alarm (Item 24, Fig. 60). If this switch is cut out, penalty brake applications from the alerter system will not occur. However, the audio alarm is still active (cannot be cut out).

### Overspeed

See Overspeed Cut-Out Switch (Item 36, Fig. 12) and Overspeed Alarm (Item 25, Fig. 60). If this switch is cut out, penalty brake applications from the locomotive IFC overspeed system will not occur. However, the audio alarm is still active (cannot be cut out). If overspeed is set lower than the limits described in the **SAFETY DEVICES** section of this manual, possible cause could be wrong wheel size selection in IFC.

**NOTE:** If a problem occurs with the penalty brake function in the electronic air brake

**equipment, it may be necessary to cut out BOTH the alerter and overspeed functions on the EC panel to avoid a penalty application. Always be governed by Railroad Rules and Procedures when cutting out safety devices.**

**NOTE:** Wheel size selection is a function which is performed by maintenance personnel. If wheel size is suspect in low overspeed setting, contact maintenance personnel.

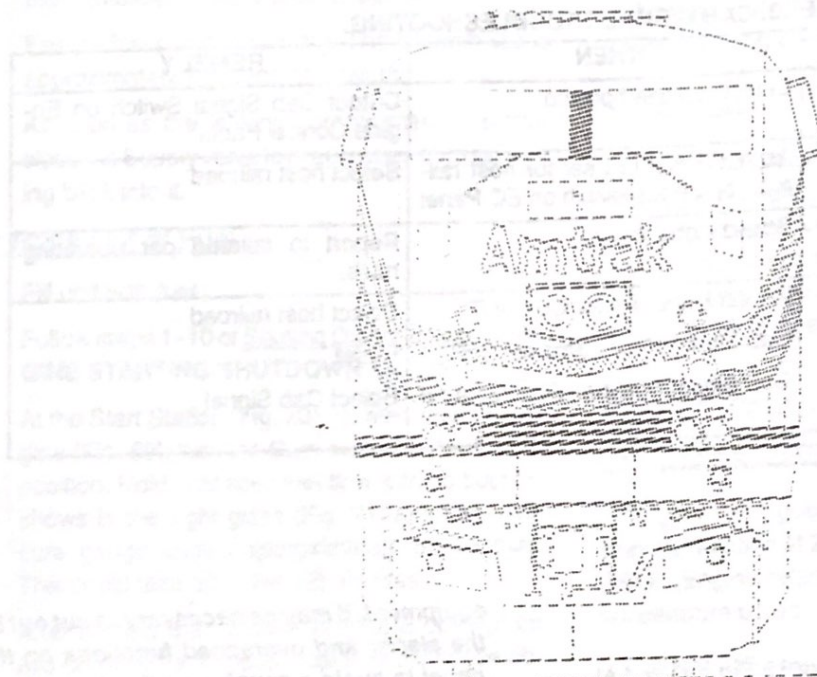
### IITS

IITS does not communicate with IFC, and should an internal fault occur, no messages will be displayed.

If the penalty cannot be reset using the above procedure, cut out the ATS as follows:

1. Turn off Cab Signal cut-out switch.
2. Turn off the Cab Signal circuit breaker, located on the engine control panel.







## AIR BRAKE TROUBLESHOOTING

### AIR BRAKE RECOVERY

**NOTE:** Refer to **AIR BRAKE EQUIPMENT** section of this publication for emergency and penalty brake reset procedures.

**WARNING: STOPPING HAZARD.** Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 50 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

**WARNING: STOPPING HAZARD.** If 24 Volt power loss and Locomotive battery power loss to the NYAB/KNORR System occurs or system experiences an internal fatal failure, on LEAD UNIT, while train is in motion, a SERVICE Brake application is made (BP goes to zero and BC goes to 90 psig). Operator may NOT bail off BC pressure. Operator may still initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Control Console Left or moving the Automatic Brake Handle to EMERGENCY position.

### Lead Unit

**NOTE:** Air brake recovery on trailing units in a consist should automatically occur as controlled from lead unit. If a trailing unit is suspect in preventing recovery, see next section on Trailing Unit.

If the recovery procedures (pages 31 and 32) in the **AIR BRAKE EQUIPMENT** section of this manual do not reset the E-Brake and PCS, proceed as follows:

1. Turn off (OPEN) the Air Brake Computer circuit breaker (Item 10, Fig.12) on the EC Panel.
2. Wait five (5) seconds.
3. Turn on (CLOSE) the Air Brake Computer circuit breaker on the EC Panel.
4. Move the Automatic Brake Valve Handle to SUPPRESSION and follow the instructions on the IFD screen.

If, after following the above procedure, the brake system still cannot be recovered, proceed as follows:

1. Turn off (OPEN) the Air Brake Computer circuit breaker (Item 10, Fig.12) on the EC Panel.
2. Turn off (OPEN) Battery Charge and Computer circuit breaker (Item 18, Fig.12) on the EC Panel.
3. Wait five (5) seconds.
4. Turn on (CLOSE) the Battery Charge and Computer circuit breaker on the EC Panel.
5. Wait until the computer reboots and IFD screens are displayed again.
6. Turn on (CLOSE) the Air Brake Computer circuit breaker on the EC Panel.
7. Move the Automatic Brake Valve Handle to SUPPRESSION and follow the instructions on the IFD screen.

### Trailing Unit

**NOTE:** Air brake recovery on trailing units in a consist should automatically occur as controlled from lead unit.

If a trailing unit is suspect in preventing recovery, proceed as follows:

1. Set up the lead unit for TRAIL. (See **OPERATING PROCEDURES** section of this manual.)
2. Set up the suspected trailing unit for LEAD. (See **OPERATING PROCEDURES** section of this manual.)
3. Use the procedures above for LEAD UNIT to attempt recovery.
4. After recovery has been accomplished, set units back up to original LEAD and TRAIL configurations.

### Cannot Recover E-Brake System

If the brake system cannot be recovered, after the following procedures above, proceed as follows:

1. The Air Brake Computer circuit breaker (Item 10, Fig.12) on the EC Panel should be turned off (OPEN) and left off.
2. The unit MUST be operated as a trailing unit. The NYAB/KNORR air brake system will operate in "back-up" mode with the Air Brake Computer circuit breaker turned off. In this configuration, the system will provide normal brake operation as a trailing unit except for the following:



- a. Maximum Independent Brake Cylinder pressure is limited to 45 psig.
- b. The bail off ring on the lead unit must be held up for a minimum of eight (8) seconds to bail off any brake cylinder pressure from an automatic brake application on a trailing unit in "back-up" mode.
- c. The unit in "back-up" mode will NOT lead.
- d. No Blended Brake (manual dynamic brakes continue to function).

**NOTE:** *If power cannot be restored to the E-Brake on the LEAD unit of the consist, it may be required to set up the failed unit as TRAIL and a trailing unit as LEAD. This will allow control of the brake system for movement to a point where the failed (LEAD) unit can be switched back in the consist. Follow Railroad Rules and Procedures.*

### E-Brake Power Loss

If there is a loss of power to the NYAB/NKORR electronic air brake system, the system will enter pneumatic "back-up" mode as follows:

1. If the unit is the LEAD unit of a consist, a PENALTY brake application will occur. An E-Brake power loss on a trailing unit will not cause a penalty brake application.
2. The alarm bell will sound. This bell is MU trainlined and will ring on all units in the consist. The bell can be silenced by pressing the Trainline Ground Relay Reset/E-Brake Alarm Silence pushbutton (Item 28, Fig. 5).
3. If Air Brake Computer circuit breaker (Item 10, Fig. 12) is tripped, attempt to reset to restore power.
4. If the unit is the LEAD unit of a consist and power cannot be restored to the E-Brake, follow the instructions under Cannot Recover Brake System above.

**NOTE:** *If power cannot be restored to the E-Brake on the LEAD unit of the consist, it may be required to set up the failed unit as TRAIL and a trailing unit as LEAD. This will allow control of the brake system for movement to a point where the failed (LEAD) unit can be switched back in the consist. Follow Railroad Rules and Procedures.*

### E-Brake Fault Reset/Alarm Silence

**NOTE:** *To silence E-Brake alarms, press the Trainline Ground Relay reset/ E-brake Alarm Silence pushbutton on the control console right (Item 28, Fig. 5).*

E-Brake faults are reset automatically by the computer. If the computer cannot reset the fault, there are no manual resets which the operator can perform other than toggling the Air Brake Computer circuit breaker (Item 10, Fig. 12). Follow the procedures listed under Lead Unit above to toggle Air Brake Computer circuit breaker.

### AIR BRAKE EQUIPMENT

#### Compressor Pumps Continuously

Check Compressor Cut-Out Cock – It should be cut in (Item 1, Fig. 23).

Check that the Compressor Governor Test Fitting is installed (Item 2, Fig. 23).

#### Compressor Rotates But Does Not Pump Air

Check that the Compressor Governor Test Fitting is installed (Item 2, Fig. 23).

Check that the Compressor Magnet Valve (CMV) (Item 3, Fig. 20) is not mechanically latched down in the "unload" position.

#### Parking Brake Does Not Release

See Fault Reset Table summary message "WARNING! Parking Brake Applied," fault 42E5. In addition, check that the Parking Brake Reservoir Drain Cock (Item 1, Fig. 27) is closed and the Auxiliary Air Cut-Out Cock (Item 1, Fig. 24) is cut in.

#### No Brake Cylinder Pressure on Any Unit in Consist

If air is heard exhausting underfloor, check that the Dead Engine Cut-Out Cock (Item 1, Fig. 18) is cut out.

#### No Horn, Bell, Wipers and Sanders

If all the horn, bell, wipers, and sander devices do not function, check the Auxiliary Air Cut-Out Cock (Item 1, Fig. 24) is cut in. If one or more of the above devices operates, check individual device cut-out cocks. (See **AIR BRAKE EQUIPMENT** section of this manual for location.)



## NOTES

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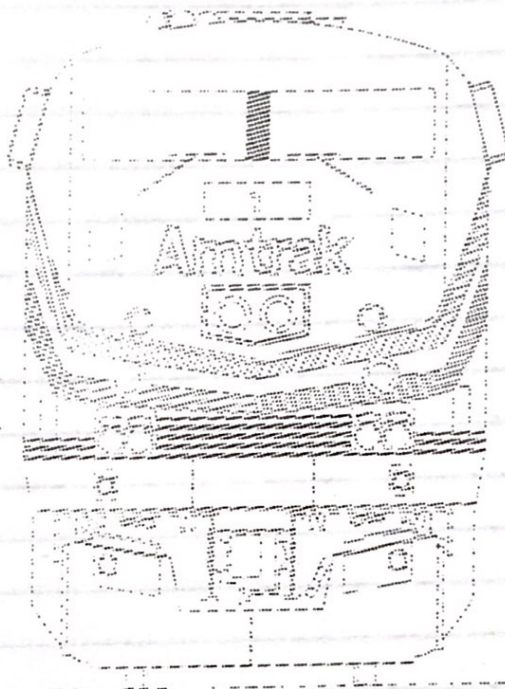


## NOTES



## This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the paper.







# LIST OF SELF - TESTS

## AND

## REQUIREMENTS

| No. | Description of Self-Test | Requirements |         |
|-----|--------------------------|--------------|---------|
|     |                          | Minimum      | Maximum |
| 1   | Self-Test 1 (ST-1)       | Yes          | 10      |
| 2   | Self-Test 2 (ST-2)       | Yes          | 10      |
| 3   | Self-Test 3 (ST-3)       | Yes          | 10      |
| 4   | Self-Test 4 (ST-4)       | Yes          | 10      |
| 5   | Self-Test 5 (ST-5)       | Yes          | 10      |
| 6   | Self-Test 6 (ST-6)       | Yes          | 10      |
| 7   | Self-Test 7 (ST-7)       | Yes          | 10      |
| 8   | Self-Test 8 (ST-8)       | Yes          | 10      |
| 9   | Self-Test 9 (ST-9)       | Yes          | 10      |
| 10  | Self-Test 10 (ST-10)     | Yes          | 10      |
| 11  | Self-Test 11 (ST-11)     | Yes          | 10      |
| 12  | Self-Test 12 (ST-12)     | Yes          | 10      |
| 13  | Self-Test 13 (ST-13)     | Yes          | 10      |
| 14  | Self-Test 14 (ST-14)     | Yes          | 10      |
| 15  | Self-Test 15 (ST-15)     | Yes          | 10      |
| 16  | Self-Test 16 (ST-16)     | Yes          | 10      |
| 17  | Self-Test 17 (ST-17)     | Yes          | 10      |
| 18  | Self-Test 18 (ST-18)     | Yes          | 10      |
| 19  | Self-Test 19 (ST-19)     | Yes          | 10      |
| 20  | Self-Test 20 (ST-20)     | Yes          | 10      |
| 21  | Self-Test 21 (ST-21)     | Yes          | 10      |
| 22  | Self-Test 22 (ST-22)     | Yes          | 10      |
| 23  | Self-Test 23 (ST-23)     | Yes          | 10      |
| 24  | Self-Test 24 (ST-24)     | Yes          | 10      |
| 25  | Self-Test 25 (ST-25)     | Yes          | 10      |
| 26  | Self-Test 26 (ST-26)     | Yes          | 10      |
| 27  | Self-Test 27 (ST-27)     | Yes          | 10      |
| 28  | Self-Test 28 (ST-28)     | Yes          | 10      |
| 29  | Self-Test 29 (ST-29)     | Yes          | 10      |
| 30  | Self-Test 30 (ST-30)     | Yes          | 10      |
| 31  | Self-Test 31 (ST-31)     | Yes          | 10      |
| 32  | Self-Test 32 (ST-32)     | Yes          | 10      |
| 33  | Self-Test 33 (ST-33)     | Yes          | 10      |
| 34  | Self-Test 34 (ST-34)     | Yes          | 10      |
| 35  | Self-Test 35 (ST-35)     | Yes          | 10      |
| 36  | Self-Test 36 (ST-36)     | Yes          | 10      |
| 37  | Self-Test 37 (ST-37)     | Yes          | 10      |
| 38  | Self-Test 38 (ST-38)     | Yes          | 10      |
| 39  | Self-Test 39 (ST-39)     | Yes          | 10      |
| 40  | Self-Test 40 (ST-40)     | Yes          | 10      |
| 41  | Self-Test 41 (ST-41)     | Yes          | 10      |
| 42  | Self-Test 42 (ST-42)     | Yes          | 10      |
| 43  | Self-Test 43 (ST-43)     | Yes          | 10      |
| 44  | Self-Test 44 (ST-44)     | Yes          | 10      |
| 45  | Self-Test 45 (ST-45)     | Yes          | 10      |
| 46  | Self-Test 46 (ST-46)     | Yes          | 10      |
| 47  | Self-Test 47 (ST-47)     | Yes          | 10      |
| 48  | Self-Test 48 (ST-48)     | Yes          | 10      |
| 49  | Self-Test 49 (ST-49)     | Yes          | 10      |
| 50  | Self-Test 50 (ST-50)     | Yes          | 10      |



LIST OF SELF - TESTS

AND

REQUIREMENTS



**TABLE 2. LIST OF SELF-TESTS AND REQUIREMENTS.**

"No" indicates that the Test will **not** be performed in AUTO Self-Test;

"Yes" indicates that the Test will be performed in MANUAL and/or AUTO Self-Test; and

"Yes IF:" indicates that the Test will be performed if all "IF" requirements are met, see Notes 1 and 2.

**NOTE 1: In Manual Test, these "IF requirements" include such items as:**

- Locomotive set-up.
- Advise that Operator must wait for certain systems to Start.
- WARNINGS, which must be acknowledged.
- Requests that other Tests Be run.

*In Auto-Test, these "IF requirements" are limited to locomotive set-up. If the locomotive is not set-up correctly, the Test will NOT be run.*

**NOTE 2: Some tests are also dependent on locomotive model information.**

**NOTE 3: Test of optional equipment – locomotive must be so equipped for test to be run.**

| Test No. | Self-Test Name   | Performance if Requirements as Noted are met<br>(See List of "IF" requirements, Table 3) |                |
|----------|--|--|----------------|
|          |  | MANUAL TEST  | AUTOMATIC TEST |
| 3        | Bell Ring Relay (BLR)  | Yes If: 3  | No             |
| 6        | Fuel Pump Relay (FPR)  | Yes If: 17 and 18  | No             |
| 9        | Water Fill Relay (WFR) (see Note 3)  | Yes If: 32   | No             |
| 12       | Wheelslip Alarm Relay (WSR)  | Yes  | No             |
| 18       | Alt Fid Reference (ICALL)  | Yes  | Yes            |
| 21       | Jog Relay (JGR) (see Note 3)   | Yes If: 21, 24   | No             |
| 24       | AUXLINE  | Yes  |                |
| 30       | BRAINLINE  | Yes  |                |
|          | These tests check that both links of the communication line are functional |  |                |
| 33       | Load Box Select Sw (LBSS)  | Yes  | No             |
| 36       | Load Box Toggle Sw (LBTS)  | Yes If: 3  | No             |
| 39       | Fan Reverse Switch (FRB)   | Yes  | No             |
| 48       | Motor Cut-Out Sw 1 (MC01)  | Yes  | No             |
| 51       | Motor Cut-Out Sw 2 (MC02)  | Yes  | No             |
| 54       | Motor Cut-Out Sw 3 (MC03)  | Yes  | No             |
| 57       | Motor Cut-Out Sw 4 (MC04)  | Yes  | No             |
| 60       | Motor Cut-Out Sw 5 (MC05)  | Yes If: 33   | No             |
| 63       | Motor Cut-Out Sw 6 (MC06)  | Yes If: 33   | No             |
| 66       | Speed Sensor Cut-Out (SCO)   | Yes  | No             |
| 69       | Eng Cntl Sw with Jog (EC) (see Note 3)                                     | Yes  | No             |
| 72       | Engine Control Sw (EC)   | Yes  | No             |
| 75       | Engine Stop Switch (ESP)   | Yes  | No             |
| 78       | Water Drain Brkr (WDCB) (see Note 3)                                       | Yes  | No             |
| 81       | SPEEDOMETER (See Note 3)   | N/A  |                |
| 84       | LOADMETER (LA)   | N/A  |                |



TABLE 2 (Cont'd.)

| Test No. | Self-Test Name                             | Performance if Requirements as Noted are met<br>(See List of "IF" requirements, Table 3) |                |
|----------|--|--|----------------|
|          |  | MANUAL TEST  | AUTOMATIC TEST |
| 87       | Combined Power Handle, Throttle (TH)       | Yes  | No             |
| 90       | Reverse Handle (RSoft Key)                 | Yes  | No             |
| 93       | Combined Power Handle, Brake               | Yes  | No             |
| 96       | Attendant Call (ATC)                       | Yes  | No             |
| 99       | TL23 Sand Switch (SSW)                     | Yes  | No             |
| 102      | N7 Power Limit Sw (PLS) (see Note 3)       | Yes  | No             |
| 105      | Power Reduction Sw (PRS) (see Note 3)      | Yes If: 8  | No             |
| 108      | Spotter Button (SB) (See Note 3)           | Yes If: 21, 24   | No             |
| 111      | Overspeed Mag Valve (OSV) (see Note 3)     | Yes If: 30   | No             |
| 114      | Reverse Sand Valve (RSCV)                  | Yes  | No             |
| 117      | Forward Sand Valve (FSCV)                  | Yes  | No             |
| 120      | Brake Pressure Sw (IBS)                    | Yes If: 21   | No             |
| 123      | Air Conditioner Enable (AIRC) (see Note 3) | Yes If: 1, 11, 12,<br>13, 16, 35, 36, 37   | No             |
| 240      | Engine Start Switch (EST)                  | Yes If: 4, 25  | No             |
| 243      | Cranker Start Input                        | Yes If: 17, 18, 25   | No             |
| 246      | Air Filter Pres Sw (EFPS)                  | Yes  | No             |
| 261      | Equipment Blower (EBP)                     | Yes If: 1, 11, 12, 13, 14, 26, 27, 28, 29  |                |
| 267      | Rad Fan Drive (RFP)                        | Yes If: 1, 11, 12, 13, 15, 26, 27, 29  |                |
| 300      | Power Contactor 1 (P1)                     | Yes If: 5  |                |
| 303      | Power Contactor 2 (P2)                     | Yes If: 5  |                |
| 306      | Power Contactor 3 (P3)                     | Yes If: 5  |                |
| 309      | Power Contactor 4 (P4)                     | Yes If: 5  |                |
| 312      | Power Contactor 5 (P5)                     | Yes If: 5 and 33   |                |
| 315      | Power Contactor 6 (P6)                     | Yes If: 5 and 33   |                |
| 318      | Self-Load Box Sw 1 (LBS1) (see Note 3)     | Yes If: 6  |                |
| 321      | Self-Load Box Sw 2 (LBS2) (see Note 3)     | Yes If: 6 and 34   |                |
| 324      | Self-Load Box Sw 3 (LBS3) (see Note 3)     | Yes If: 6  |                |
| 327      | Self-Load Box Sw 4 (LBS4) (see Note 3)     | Yes If: 6  |                |
| 330      | Dyn Brake Contactor (B1) (see Note 3)      | Yes If: 5  |                |
| 360      | Dyn Br Contactor 1 (DB1) (see Note 3)      | Yes  |                |
| 363      | Dyn Br Contactor 2 (DB2) (see Note 3)      | Yes  |                |
| 366      | Dyn Br Contactor 3 (DB3) (see Note 3)      | Yes  |                |
| 369      | Dyn Br Contactor 4 (DB4) (see Note 3)      | Yes  |                |
| 372      | Dyn Br Contactor 5 (DB5) (see Note 3)      | Yes  |                |
| 375      | Dyn Br Contactor 6 (DB6) (see Note 3)      | Yes  |                |
| 378      | Dyn Br Contactor 7 (DB7) (see Note 3)      | Yes If: 33   |                |
| 381      | Dyn Br Contactor 8 (DB8) (see Note 3)      | Yes If: 33   |                |
| 384      | Dyn Br Contactor 9 (DB9) (see Note 3)      | Yes If: 33   |                |
| 402      | Alt Blwr Contactor (ABC)                   | Yes  |                |
| 405      | Alt Field Contactor (AFC)                  | Yes If: 3 and 9  |                |
| 408      | Fld Flashing Relay (FFR)                   | Yes  | No             |



TABLE 2 (Cont'd.)

| Test No.   | Self-Test Name   | Performance if Requirements as Noted are met<br>(See List of "IF" requirements, Table 3)   |  |
|--|--|--|--|
|  |  | MANUAL TEST  | AUTOMATIC TEST                               |
| 411<br>414<br>416                                    | Aux Field Contactor (XFC)<br>Battery Regulator (BRP)<br>Crank Sequence Cont (GSS)  | Yes If: 11 and 12<br>Yes If: 1, 11, 12, 13, 16, 26, 27, 29, 31<br>Yes If: 2 and 4  |  |
| 417<br>420   | Eng Crank Contactor (GSC)<br>Eng Crank Contactor (GS+)   | Yes If: 2, 4, 17,<br>18, 20<br>Yes If: 2, 4, 17,<br>18, 20   | No<br>No                                     |
| 423<br>426   | Crank Field Cont 1 (BFC1)<br>Crank Field Cont 2 (BFC2)   | Yes If: 2 and 4<br>Yes If: 2 and 4   |  |
| 429<br>432<br>435<br>438<br>441<br>444<br>447<br>450 | Crank Thyristor 1 (CTP1)<br>Crank Thyristor 4 (CTP1)<br>Crank Thyristor 3 (CTP2)<br>Crank Thyristor 6 (CTP2)<br>Crank Thyristor 5 (CTP3)<br>Crank Thyristor 2 (CTP3)<br>Crank Thyristor 7 (CTP4)<br>Crank Thyristor 8 (CTP4) | Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22 | No<br>No<br>No<br>No<br>No<br>No<br>No<br>No |
| 453  | Ring Crank Cap CTP1 (CCC)  | Yes If: 2, 4, 11,<br>17, 28, 20, 22, 23  | No   |
| 456  | Ring Crank Cap CTP2 (CCC)  | Yes If: 2, 4, 11,<br>17, 28, 20, 22, 23  | No   |
| 459  | Ring Crank Cap CTP3 (CCC)  | Yes If: 2, 4, 11,<br>17, 28, 20, 22, 23  | No   |
| 462<br>465<br>468<br>471<br>474                      | Phase A Crank Input (HVM)<br>Phase B Crank Input (HVM)<br>Phase C Crank Input (HVM)<br>CCC Polarity Input (HVM)<br>CCC Maximum Voltage (HVM)   | Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22<br>Yes If: 2 and 22   | No<br>No<br>No<br>No<br>No                   |
| 540<br>543<br>546<br>549                             | Governor A Spd Valve (AV)<br>Governor B Spd Valve (BV)<br>Governor C Spd Valve (CV)<br>Governor D Spd Valve (DV)   | Yes If: 7<br>Yes If: 3 and 7<br>Yes If: 7<br>Yes If: 7   | No<br>No<br>No<br>No                         |
| 600<br>603   | Braking Sw Motor (BKT(M)) (see Note 3)<br>Braking Sw Brake (BKT(B)) (see Note 3)   | Yes If: 9<br>Yes If: 10  |  |
| 633<br>636<br>639<br>642                             | Res. Drain Valves (RDV)<br>Water Flow Magnet Valve (WFMV)<br>Electric Air Dryer (EAD) (see Note 3)<br>Compressor Magnet Valve  | Yes<br>Yes If: 19<br>Yes<br>Yes  | No<br>No<br>No<br>No                         |
| 645<br>648   | Compressor Drive 1 (CDC1)<br>Compressor Drive 2 (CDC2)   | Yes<br>Yes   |  |



TABLE 2 (Cont'd.)

| Test No. | Self-Test Name                                      | Performance if Requirements as Noted are met<br>(See List of "IF" requirements, Table 3) |                |
|----------|---|--|----------------|
|          |   | MANUAL TEST  | AUTOMATIC TEST |
| 699      | Blended Brake Relay (BBR)                           | Yes  | No             |
| 702      | Blended Brake Amplifier (BBA)                       | Yes If: 21   | No             |
| 703      | Blended Brake (EAB)                                 | Yes If: 21   | No             |
| 705      | Head End Box Door Interlocks (DIS-2, -4)            | Yes  | No             |
| 708      | Head End Field Contactor (HEFC)                     | Yes  | No             |
| 711      | Head End Field Flashing Relay (HEFFR)               | Yes  | No             |
| 714      | Head End Power Alternator (HEA)                     | Yes If: 3  | No             |
| 717      | Head End Power Contactor Relay (HEPCR)              | Yes  | No             |
| 720      | HE Power F-End Isolate Switch (HEIS)                | Yes  | No             |
| 723      | Head End Power Mode Switch (HEPMS)                  | Yes  | No             |
| 729      | HE Power On/Off Switch (HEPON/HEPOFF)               | Yes  | No             |
| 732      | Head End Transfer Switch (HETS)                     | Yes  | No             |
| 735      | Lead Isolate Switch (LIS)                           | Yes  | No             |
| 741      | Operate Tract. Alter. (TA) in HEP Standby           | Yes  | No             |
| 744      | Redundant Battery Chg. Controller (RBCC)            | Yes  | No             |
| 747      | Trainline Relay (TR)                                | Yes  | No             |
| 750      | Wayside Transfer Switch (WTS)                       | Yes  | No             |
| 753      | Wheelslide Magnet Valve (WSMV)                      | Yes If: 21   | No             |
| 756      | AUX Receives from CAB on Brainline Link A           | Yes  | No             |
| 759      | AUX Receives from CAB on Brainline Link B           | Yes  | No             |
| 762      | CAB Receives from AUX on Brainline Link A           | Yes  | No             |
| 765      | CAB Receives from AUX on Brainline Link B           | Yes  | No             |
| 768      | CAB Receives from EXC on Brainline Link A           | Yes  | No             |
| 771      | CAB Receives from EXC on Brainline Link B           | Yes  | No             |
| 774      | CAB Receives from HEP on Brainline Link A           | Yes  | No             |
| 777      | CAB Receives from HEP on Brainline Link B           | Yes  | No             |
| 780      | EXC Receives from CAB on Brainline Link A           | Yes  | No             |
| 783      | EXC Receives from CAB on Brainline Link B           | Yes  | No             |
| 786      | HEP Receives from CAB on Brainline Link A           | Yes  | No             |
| 789      | HEP Receives from CAB on Brainline Link B           | Yes  | No             |
| 792      | Braking-Motoring Switch (BMS) in SELF-LOAD Position | Yes  | Yes            |
| 795      | Center BMS from SELF-LOAD Position                  | Yes  | Yes            |
| 798      | BMS in BRAKING Position                             | Yes  | Yes            |
| 801      | Center BMS From BRAKING Position                    | Yes  | Yes            |
| 804      | Hostler Station Speed Limit Relay (HSLR)            | Yes  | No             |
| 807      | Hot Bearing Detection System (HBDP and HBDR)        | Yes  | No             |
| 810      | Parking Brake Input (PBPS1 and PBPS2)               | Yes  | No             |
| 813      | Shutter Magnet Valves (SMV1 and SMV2)               | Yes  | No             |
| 816      | Traction Motor Cutout Relay (MCOR)                  | Yes  | No             |



# REQUIREMENTS FOR MANUAL AND AUTOMATIC SELF - TEST

| Test Item  | Description of Test                                  | Pass/Fail Criteria |
|--|--|--------------------|
| 1. Visual inspection of the unit for damage, corrosion, or missing components. | No visible damage, corrosion, or missing components. | Pass               |
| 2. Check the battery voltage and ensure it is fully charged.                   | Battery voltage is above 12.5V.                      | Pass               |
| 3. Perform a manual self-test by pressing the test button.                     | The test sequence completes successfully.            | Pass               |
| 4. Check the output of the test sequence for correct values.                   | Output values are within specified tolerances.       | Pass               |
| 5. Perform an automatic self-test by setting the unit to automatic mode.       | The automatic test sequence completes successfully.  | Pass               |
| 6. Check the output of the automatic test sequence for correct values.         | Output values are within specified tolerances.       | Pass               |



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**TABLE 3.**  
**"IF" REQUIREMENTS FOR MANUAL AND AUTOMATIC SELF-TEST.**

The following REQUIREMENTS must be met in order for the Self-Test steps listed in Table 2 to be performed.

**NOTE: In Manual Test, the operator will be alerted to the requirements needed to perform the test. In Auto Test, if locomotive set-up does not meet the requirements, the Test will be skipped.**

| No. | Restriction Description  | Message to Operator  |                   |
|-----|--|--|-------------------|
|     |  | Message Line   | Soft Key*         |
| 1   | Measured diesel speed must be GREATER THAN 240 RPM   | No message line  | No soft key label |
| 2   | Diesel engine must be SHUT-DOWN  | Engine must be stopped for this test                           |                   |
| 3   | Engine Control switch (EC) in RUN  | Set Engine Control switch to RUN                               |                   |
| 4   | Engine Control switch (EC) in START  | Move EC switch to START  |                   |
|     | <b>NOTE: For Self-Test 453, 456, 459 hold for at least 20 seconds.</b>                               |  |                   |
| 5   | Self-Load Box Toggle Switch (LBTS) in NORMAL   | Move LBTS to NORMAL  |                   |
| 6   | Self-Load Box Toggle Switch (LBTS) in SELF-LOAD  | Move LBTS to SELF-LOAD   |                   |
| 7   | ADVISES operator that if the engine is NOT running, incorrect values will be displayed               | Engine not running, disregard RPM values                       | Did_It            |
| 8   | Reverser handle must be in REVERSE position  | Move Reverser handle towards long-hood                         |                   |
| 9   | GF Trainline (No. 6) or KG wire must be energized  | Turn on Gen Field, move Combined Power (Throttle) handle to N1 |                   |
| 10  | B Trainline (No. 17) must be energized   | Move Combined Power (Brake) handle to SET-UP                   |                   |
| 11  | CA2 compartment door closed (DIS)  | Close CA2 compartment door                                     | Did_It            |
| 12  | Auxiliary Alternator Field Cut-Out switch (BFCO) in NORMAL   | Move BFCO switch to NORMAL                                     | Did_It            |
| 13  | Auxiliary Alternator FAULTS must be repaired   | Aux Alt FAULT must be repaired                                 |                   |
| 14  | Equipment Blower Motor Drive Regulator (EBP) FAULTS must be repaired                                 | EBP FAULT must be repaired                                     |                   |
| 15  | Radiator Fan Motor Drive Regulator (RFP) FAULTS must be repaired                                     | RFP FAULT must be repaired                                     |                   |
| 16  | Battery charger FAULTS must be repaired  | Battery charger FAULT must be repaired                         |                   |
| 17  | Fuel pump must be energized  | Turn on FPB. Move Eng Start switch to PRIME                    | Did_It            |
| 18  | Fuel Cut-Out switches and Interlocks must be closed  | Check FCORS, FCOLS, ESP1, ESP2                                 | Did_It            |
| 19  | Ambient (outside air) temperature must be above 40 F OR engine water temperature must be above 130 F | Ambient or engine water too cold                               |                   |
| 20  | Engine Start switch (EST) in START   | Move Engine Start switch to START                              |                   |

**\*NOTE: Stop, Monitor and History soft keys appear with all restriction message lines.**



TABLE 3 (Cont'd.)

| No. | Restriction Description   | Message to Operator                            |           |
|-----|---|--|-----------|
|     |   | Message Line                                   | Soft Key* |
| 21  | WARNS operator that loco may move   | <b>CAUTION: Unit may move (chock wheels)</b>   | Did_It    |
| 22  | WARNS operator that HIGH VOLTAGE MAY BE PRESENT                                 | <b>CAUTION: High volts crank capacitor CCC</b> | .Noted    |
| 23  | WARNS operator that Crank Capacitor Ring Up is in progress                      | Ring Up in progress                            | Noted     |
| 24  | REQUESTS that BKT(B) TEST be run  | Move BKT to BRAKE (run Self-Test [603])        | Noted     |
| 25  | INFORM operator that two people may be needed to perform test                   | This test requires two people                  |           |
| 26  | ADVISES operator must wait for ABC cycle reduction                              | Waiting for ABC cycling delay                  |           |
| 27  | ADVISES operator must wait for BFR cycle reduction                              | Waiting for BFR cycling delay                  |           |
| 28  | ADVISES operator must wait for EBP cycle reduction                              | Waiting for EBP cycling delay                  |           |
| 29  | ADVISES operator must wait for auxiliary system to start                        | Auxiliary systems starting                     |           |
| 30  | Must be equipped with GE speedometer  | Waiting for BRP cycling delay                  |           |
| 31  | ADVISES operator must wait for BRP cycle reduction                              |  |           |
| 32  | Water Dump Circuit Breaker (WDCB) must be CLOSED                                | Turn on Water Drain Circuit Breaker (WDCB)     |           |
| 33  | "C" locomotive only (6 axle)  | No message line                                |           |
| 34  | "B" locomotive only (4 axle)  | No message line                                |           |
| 35  | ADVISES operator that Test cannot be run due to high Battery Charger current    | High battery charge current restriction        |           |
| 36  | ADVISES operator that air conditioner will not run until pressure delay is over | Wait (3 minutes max.) for pressure reduction   |           |
| 37  | REQUEST for operator to turn ON air conditioner                                 | Turn on Air Conditioner                        | Did_It    |

\*NOTE: Stop, Monitor and History soft keys appear with all restriction message lines.



TABLE 1. CAB MONITOR PARAMETER NUMBERS (100K Series)

| PARAMETER | NUMBER | DESCRIPTION                             |
|-----------|--------|---|
| 1000      | 1000   | Anti-Lock Braking Pressure = xx - 0000  |
| 1001      | 1001   | Brake Fan Air-Cycle Load = xx HP (14)   |
| 1002      | 1002   | Brake Water Temperature By ALU = xx Hex |
| 1003      | 1003   | CAB Control A = 000000 00000000         |
| 1004      | 1004   | CAB Control C = 000000 00000000         |
| 1005      | 1005   | CAB Control D = 000000 00000000         |
| 1006      | 1006   | CAB Control E = 000000 00000000         |
| 1007      | 1007   | CAB Control F = 000000 00000000         |
| 1008      | 1008   | CAB Control G = 000000 00000000         |
| 1009      | 1009   | CAB Control H = 000000 00000000         |
| 1010      | 1010   | CAB Control I = 000000 00000000         |
| 1011      | 1011   | CAB Control J = 000000 00000000         |
| 1012      | 1012   | CAB Control K = 000000 00000000         |
| 1013      | 1013   | CAB Control L = 000000 00000000         |
| 1014      | 1014   | CAB Control M = 000000 00000000         |
| 1015      | 1015   | CAB Control N = 000000 00000000         |
| 1016      | 1016   | CAB Control O = 000000 00000000         |
| 1017      | 1017   | CAB Control P = 000000 00000000         |
| 1018      | 1018   | CAB Control Q = 000000 00000000         |
| 1019      | 1019   | CAB Control R = 000000 00000000         |
| 1020      | 1020   | CAB Control S = 000000 00000000         |
| 1021      | 1021   | CAB Control T = 000000 00000000         |
| 1022      | 1022   | CAB Control U = 000000 00000000         |
| 1023      | 1023   | CAB Control V = 000000 00000000         |
| 1024      | 1024   | CAB Control W = 000000 00000000         |
| 1025      | 1025   | CAB Control X = 000000 00000000         |
| 1026      | 1026   | CAB Control Y = 000000 00000000         |
| 1027      | 1027   | CAB Control Z = 000000 00000000         |
| 1028      | 1028   | CAB Control AA = 000000 00000000        |
| 1029      | 1029   | CAB Control AB = 000000 00000000        |
| 1030      | 1030   | CAB Control AC = 000000 00000000        |
| 1031      | 1031   | CAB Control AD = 000000 00000000        |
| 1032      | 1032   | CAB Control AE = 000000 00000000        |
| 1033      | 1033   | CAB Control AF = 000000 00000000        |
| 1034      | 1034   | CAB Control AG = 000000 00000000        |
| 1035      | 1035   | CAB Control AH = 000000 00000000        |
| 1036      | 1036   | CAB Control AI = 000000 00000000        |
| 1037      | 1037   | CAB Control AJ = 000000 00000000        |
| 1038      | 1038   | CAB Control AK = 000000 00000000        |
| 1039      | 1039   | CAB Control AL = 000000 00000000        |
| 1040      | 1040   | CAB Control AM = 000000 00000000        |
| 1041      | 1041   | CAB Control AN = 000000 00000000        |
| 1042      | 1042   | CAB Control AO = 000000 00000000        |
| 1043      | 1043   | CAB Control AP = 000000 00000000        |
| 1044      | 1044   | CAB Control AQ = 000000 00000000        |
| 1045      | 1045   | CAB Control AR = 000000 00000000        |
| 1046      | 1046   | CAB Control AS = 000000 00000000        |
| 1047      | 1047   | CAB Control AT = 000000 00000000        |
| 1048      | 1048   | CAB Control AU = 000000 00000000        |
| 1049      | 1049   | CAB Control AV = 000000 00000000        |
| 1050      | 1050   | CAB Control AW = 000000 00000000        |
| 1051      | 1051   | CAB Control AX = 000000 00000000        |
| 1052      | 1052   | CAB Control AY = 000000 00000000        |
| 1053      | 1053   | CAB Control AZ = 000000 00000000        |
| 1054      | 1054   | CAB Control BA = 000000 00000000        |
| 1055      | 1055   | CAB Control BB = 000000 00000000        |
| 1056      | 1056   | CAB Control BC = 000000 00000000        |
| 1057      | 1057   | CAB Control BD = 000000 00000000        |
| 1058      | 1058   | CAB Control BE = 000000 00000000        |
| 1059      | 1059   | CAB Control BF = 000000 00000000        |
| 1060      | 1060   | CAB Control BG = 000000 00000000        |
| 1061      | 1061   | CAB Control BH = 000000 00000000        |
| 1062      | 1062   | CAB Control BI = 000000 00000000        |
| 1063      | 1063   | CAB Control BJ = 000000 00000000        |
| 1064      | 1064   | CAB Control BK = 000000 00000000        |
| 1065      | 1065   | CAB Control BL = 000000 00000000        |
| 1066      | 1066   | CAB Control BM = 000000 00000000        |
| 1067      | 1067   | CAB Control BN = 000000 00000000        |
| 1068      | 1068   | CAB Control BO = 000000 00000000        |
| 1069      | 1069   | CAB Control BP = 000000 00000000        |
| 1070      | 1070   | CAB Control BQ = 000000 00000000        |
| 1071      | 1071   | CAB Control BR = 000000 00000000        |
| 1072      | 1072   | CAB Control BS = 000000 00000000        |
| 1073      | 1073   | CAB Control BT = 000000 00000000        |
| 1074      | 1074   | CAB Control BU = 000000 00000000        |
| 1075      | 1075   | CAB Control BV = 000000 00000000        |
| 1076      | 1076   | CAB Control BW = 000000 00000000        |
| 1077      | 1077   | CAB Control BX = 000000 00000000        |
| 1078      | 1078   | CAB Control BY = 000000 00000000        |
| 1079      | 1079   | CAB Control BZ = 000000 00000000        |
| 1080      | 1080   | CAB Control CA = 000000 00000000        |
| 1081      | 1081   | CAB Control CB = 000000 00000000        |
| 1082      | 1082   | CAB Control CC = 000000 00000000        |
| 1083      | 1083   | CAB Control CD = 000000 00000000        |
| 1084      | 1084   | CAB Control CE = 000000 00000000        |
| 1085      | 1085   | CAB Control CF = 000000 00000000        |
| 1086      | 1086   | CAB Control CG = 000000 00000000        |
| 1087      | 1087   | CAB Control CH = 000000 00000000        |
| 1088      | 1088   | CAB Control CI = 000000 00000000        |
| 1089      | 1089   | CAB Control CJ = 000000 00000000        |
| 1090      | 1090   | CAB Control CK = 000000 00000000        |
| 1091      | 1091   | CAB Control CL = 000000 00000000        |
| 1092      | 1092   | CAB Control CM = 000000 00000000        |
| 1093      | 1093   | CAB Control CN = 000000 00000000        |
| 1094      | 1094   | CAB Control CO = 000000 00000000        |
| 1095      | 1095   | CAB Control CP = 000000 00000000        |
| 1096      | 1096   | CAB Control CQ = 000000 00000000        |
| 1097      | 1097   | CAB Control CR = 000000 00000000        |
| 1098      | 1098   | CAB Control CS = 000000 00000000        |
| 1099      | 1099   | CAB Control CT = 000000 00000000        |
| 1100      | 1100   | CAB Control CU = 000000 00000000        |
| 1101      | 1101   | CAB Control CV = 000000 00000000        |
| 1102      | 1102   | CAB Control CW = 000000 00000000        |
| 1103      | 1103   | CAB Control CX = 000000 00000000        |
| 1104      | 1104   | CAB Control CY = 000000 00000000        |
| 1105      | 1105   | CAB Control CZ = 000000 00000000        |
| 1106      | 1106   | CAB Control DA = 000000 00000000        |
| 1107      | 1107   | CAB Control DB = 000000 00000000        |
| 1108      | 1108   | CAB Control DC = 000000 00000000        |
| 1109      | 1109   | CAB Control DD = 000000 00000000        |
| 1110      | 1110   | CAB Control DE = 000000 00000000        |
| 1111      | 1111   | CAB Control DF = 000000 00000000        |
| 1112      | 1112   | CAB Control DG = 000000 00000000        |
| 1113      | 1113   | CAB Control DH = 000000 00000000        |
| 1114      | 1114   | CAB Control DI = 000000 00000000        |
| 1115      | 1115   | CAB Control DJ = 000000 00000000        |
| 1116      | 1116   | CAB Control DK = 000000 00000000        |
| 1117      | 1117   | CAB Control DL = 000000 00000000        |
| 1118      | 1118   | CAB Control DM = 000000 00000000        |
| 1119      | 1119   | CAB Control DN = 000000 00000000        |
| 1120      | 1120   | CAB Control DO = 000000 00000000        |
| 1121      | 1121   | CAB Control DP = 000000 00000000        |
| 1122      | 1122   | CAB Control DQ = 000000 00000000        |
| 1123      | 1123   | CAB Control DR = 000000 00000000        |
| 1124      | 1124   | CAB Control DS = 000000 00000000        |
| 1125      | 1125   | CAB Control DT = 000000 00000000        |
| 1126      | 1126   | CAB Control DU = 000000 00000000        |
| 1127      | 1127   | CAB Control DV = 000000 00000000        |
| 1128      | 1128   | CAB Control DW = 000000 00000000        |
| 1129      | 1129   | CAB Control DX = 000000 00000000        |
| 1130      | 1130   | CAB Control DY = 000000 00000000        |
| 1131      | 1131   | CAB Control DZ = 000000 00000000        |
| 1132      | 1132   | CAB Control EA = 000000 00000000        |
| 1133      | 1133   | CAB Control EB = 000000 00000000        |
| 1134      | 1134   | CAB Control EC = 000000 00000000        |
| 1135      | 1135   | CAB Control ED = 000000 00000000        |
| 1136      | 1136   | CAB Control EE = 000000 00000000        |
| 1137      | 1137   | CAB Control EF = 000000 00000000        |
| 1138      | 1138   | CAB Control EG = 000000 00000000        |
| 1139      | 1139   | CAB Control EH = 000000 00000000        |
| 1140      | 1140   | CAB Control EI = 000000 00000000        |
| 1141      | 1141   | CAB Control EJ = 000000 00000000        |
| 1142      | 1142   | CAB Control EK = 000000 00000000        |
| 1143      | 1143   | CAB Control EL = 000000 00000000        |
| 1144      | 1144   | CAB Control EM = 000000 00000000        |
| 1145      | 1145   | CAB Control EN = 000000 00000000        |
| 1146      | 1146   | CAB Control EO = 000000 00000000        |
| 1147      | 1147   | CAB Control EP = 000000 00000000        |
| 1148      | 1148   | CAB Control EQ = 000000 00000000        |
| 1149      | 1149   | CAB Control ER = 000000 00000000        |
| 1150      | 1150   | CAB Control ES = 000000 00000000        |
| 1151      | 1151   | CAB Control ET = 000000 00000000        |
| 1152      | 1152   | CAB Control EU = 000000 00000000        |
| 1153      | 1153   | CAB Control EV = 000000 00000000        |
| 1154      | 1154   | CAB Control EW = 000000 00000000        |
| 1155      | 1155   | CAB Control EX = 000000 00000000        |
| 1156      | 1156   | CAB Control EY = 000000 00000000        |
| 1157      | 1157   | CAB Control EZ = 000000 00000000        |
| 1158      | 1158   | CAB Control FA = 000000 00000000        |
| 1159      | 1159   | CAB Control FB = 000000 00000000        |
| 1160      | 1160   | CAB Control FC = 000000 00000000        |
| 1161      | 1161   | CAB Control FD = 000000 00000000        |
| 1162      | 1162   | CAB Control FE = 000000 00000000        |
| 1163      | 1163   | CAB Control FF = 000000 00000000        |
| 1164      | 1164   | CAB Control FG = 000000 00000000        |
| 1165      | 1165   | CAB Control FH = 000000 00000000        |
| 1166      | 1166   | CAB Control FI = 000000 00000000        |
| 1167      | 1167   | CAB Control FJ = 000000 00000000        |
| 1168      | 1168   | CAB Control FK = 000000 00000000        |
| 1169      | 1169   | CAB Control FL = 000000 00000000        |
| 1170      | 1170   | CAB Control FM = 000000 00000000        |
| 1171      | 1171   | CAB Control FN = 000000 00000000        |
| 1172      | 1172   | CAB Control FO = 000000 00000000        |
| 1173      | 1173   | CAB Control FP = 000000 00000000        |
| 1174      | 1174   | CAB Control FQ = 000000 00000000        |
| 1175      | 1175   | CAB Control FR = 000000 00000000        |
| 1176      | 1176   | CAB Control FS = 000000 00000000        |
| 1177      | 1177   | CAB Control FT = 000000 00000000        |
| 1178      | 1178   | CAB Control FU = 000000 00000000        |
| 1179      | 1179   | CAB Control FV = 000000 00000000        |
| 1180      | 1180   | CAB Control FW = 000000 00000000        |
| 1181      | 1181   | CAB Control FX = 000000 00000000        |
| 1182      | 1182   | CAB Control FY = 000000 00000000        |
| 1183      | 1183   | CAB Control FZ = 000000 00000000        |
| 1184      | 1184   | CAB Control GA = 000000 00000000        |
| 1185      | 1185   | CAB Control GB = 000000 00000000        |
| 1186      | 1186   | CAB Control GC = 000000 00000000        |
| 1187      | 1187   | CAB Control GD = 000000 00000000        |
| 1188      | 1188   | CAB Control GE = 000000 00000000        |
| 1189      | 1189   | CAB Control GF = 000000 00000000        |
| 1190      | 1190   | CAB Control GG = 000000 00000000        |
| 1191      | 1191   | CAB Control GH = 000000 00000000        |
| 1192      | 1192   | CAB Control GI = 000000 00000000        |
| 1193      | 1193   | CAB Control GJ = 000000 00000000        |
| 1194      | 1194   | CAB Control GK = 000000 00000000        |
| 1195      | 1195   | CAB Control GL = 000000 00000000        |
| 1196      | 1196   | CAB Control GM = 000000 00000000        |
| 1197      | 1197   | CAB Control GN = 000000 00000000        |
| 1198      | 1198   | CAB Control GO = 000000 00000000        |
| 1199      | 1199   | CAB Control GP = 000000 00000000        |
| 1200      | 1200   | CAB Control GQ = 000000 00000000        |







**TABLE 2. CAB MONITOR PARAMETER NUMBERS (1000 Series).**

| NUMBER | DESCRIPTION                            | NUMBER | DESCRIPTION                              |
|--------|--|--------|--|
| 1001   | Outside Air Temp. = xxx Deg. F (C)     | 1039   | Atmospheric Pressure = xx.x PSIA (kPa)   |
| 1002   | Trainline Throttle Position = x        | 1040   | Blwr, Fan, Air Comp. Load = xxxx HP (Kw) |
| 1003   | Elapsed Time = xxxxxx.xx Hrs           | 1041   | Max Notch Permitted By AUX = xx Hex      |
| 1004   | NOT REQ'D FOR TROUBLESHOOTING          | 1042   | CAB Option A = 0000000 00000000          |
| 1005   | NOT REQ'D FOR TROUBLESHOOTING          | 1043   | CAB Option B = 0000000 00000000          |
| 1006   | Road Number = xxxxx                    | 1044   | CAB Option C = 0000000 00000000          |
| 1007   | CAB Command To AUX = xx Hex            | 1045   | CAB Option D = 0000000 00000000          |
| 1008   | AUX Reply To CAB = xx Hex              | 1046   | Cab Status = 00000000                    |
| 1009   | CAB Command To EXC = xx Hex            | 1047   | CAB Time; Seconds = xx                   |
| 1010   | EXC Reply To CAB = xx Hex              | 1048   | CAB Time; Minutes = xx                   |
| 1011   | Throttle Call = xx Hex                 | 1049   | CAB Time; Hours = xx                     |
| 1012   | Local Battery Volts = xxx Volts        | 1050   | CAB Time; Day Of Week= x [1=Sunday]      |
| 1013   | CAB Time = xxxx Counts                 | 1051   | CAB Time; Day Of Month = xx              |
| 1014   | Next Fault Memory Addr = xxxx Hex      | 1052   | CAB Time; Month = xx [1 = January]       |
| 1015   | 30 Second Alarm From AUX = False       | 1053   | CAB Time; Year = xxxx                    |
| 1016   | Continuous Alarm From AUX = False      | 1054   | Motoring Pwr1 = xxxxx Kw-Hrs             |
| 1017   | 30 Second Alarm From EXC = False       | 1055   | Motoring Pwr2 = xxxxx *65536 Kw-Hrs      |
| 1018   | Continuous Alarm From EXC = False      | 1056   | Braking Pwr1 = xxxxx Kw-Hrs              |
| 1019   | 1 Hour Elapsed Timer = xx:xx           | 1057   | Braking Pwr2 = xxxxx *65536 Kw-Hrs       |
| 1020   | Input A = 00000000 00000000            | 1058   | Total Miles1 = xxxxx Miles (Km)          |
| 1021   | Input B = 00000000 00000000            | 1059   | Total Miles2 = xxxxx *65536 Miles (Km)   |
| 1022   | Input C = 00000000 00000000            | 1060   | Compressor Motor Cycles = xxxxx          |
| 1023   | Output A = 00000000                    | 1061   | Compressor Load Cycles = xxxxx           |
| 1024   | Diesel Engine Speed = xxxx RPM         | 1062   | Cranker Power = xxxxx Kill @ 8000        |
| 1025   | TM Speed; 2nd Active Axle = xxxx RPM   | 1063   | Idle Time2 = xxxxx *65536 Sec            |
| 1026   | Highest TM Armature = xxxx Amps        | 1064   | Notch1 Time 2 = xxxxx *65536             |
| 1027   | Dynamic Brake; TM Field = xxxx Amps    | 1065   | Notch2 Time 2 = xxxxx *65536             |
| 1028   | Transmit Errors To EXC/AUX = xxxxx     | 1066   | Notch3 Time 2 = xxxxx *65536             |
| 1029   | Receive Errors From EXC/AUX = xxxxx    | 1067   | Notch4 Time 2 = xxxxx *65536             |
| 1030   | Fan/Blwr Override To AUX = 00000000    | 1068   | Notch5 Time 2 = xxxxx *65536             |
| 1031   | EXC Status A = 00000000                | 1069   | Notch6 Time 2 = xxxxx *65536             |
| 1032   | EXC Status B = 00000000                | 1070   | Notch7 Time 2 = xxxxx *65536             |
| 1033   | Max Notch Permitted By EXC = xx Hex    | 1071   | Notch8 Time 2 = xxxxx *65536             |
| 1034   | Gross Diesel Avg. Power = xxxx HP (Kw) | 1072   | Dynamic Brake Time 2 = xxxxx *65536      |
| 1035   | TM Thermal Deration = xxx.xx%          | 1073   | Total Time2 = xxxxx *65536 Sec           |
| 1036   | Water Temperature = xxx Deg. F (C)     | 1074   | Idle Time1 = xxxxx Sec                   |
| 1037   | Blwr/Fan Speed Commands = 00000000     | 1075   | Notch 1 Time1 = xxxxx Sec                |
| 1038   | Oil Temperature = xxx Deg. F (C)       | 1076   | Notch 2 Time1 = xxxxx Sec                |



TABLE 2 (Cont'd)

| NUMBER | DESCRIPTION                          | NUMBER | DESCRIPTION                              |
|--------|--------------------------------------|--------|--|
| 1077   | Notch 3 Time1 = xxxxx Sec            | 1092   | Fault; Total Current = xxxxx Amps        |
| 1078   | Notch 4 Time1 = xxxxx Sec            | 1093   | Fault; Main Alt. Volts = xxxxx Volts     |
| 1079   | Notch 5 Time1 = xxxxx Sec            | 1094   | Fault; Main Alt. Field I = xxxxx Amps    |
| 1080   | Notch 6 Time1 = xxxxx Sec            | 1095   | Fault; CAB Command To Aux=00000000       |
| 1081   | Notch 7 Time1 = xxxxx Sec            | 1096   | Fault; Throttle Call To Aux = 00000000   |
| 1082   | Notch 8 Time1 = xxxxx Sec            | 1097   | Fault; EXC Status = 00000000             |
| 1083   | Dynamic Brake Time1 = xxxxx Sec      | 1098   | Fault; Water Temperature = xxx Deg F (C) |
| 1084   | Total Time1 = xxxxx Sec              | 1099   | Fault; Oil Temperature = xxx Deg F (C)   |
| 1085   | A-Field Regulator Status = 00000000  | 1100   | Fault; Blower/Fan = 00000000             |
| 1086   | A-Field Regulator Cmmnd = 00000000   | 1101   | CAB Option E = 00000000 00000000         |
| 1087   | False CAB Interrupts = xxxxx Counts  | 1102   | CAB Option F = 00000000 00000000         |
| 1088   | CAB Clock Error = False              | 1103   | CAB Option G = 00000000 00000000         |
| 1089   | CAB Software Version = xxx.xx        | 1104   | CAB Option H = 00000000 00000000         |
| 1090   | Fault; Motor Speed = xxxxx RPM       | 1105   | TM Plug Speed Limit = xxx MPH (KPH)      |
| 1091   | Fault; Diesel Engine Spd = xxxxx RPM | 1106   | HEP Restriction From EXC = 00000000      |

TABLE 3. EXC MONITOR PARAMETER NUMBERS (2000 Series).

| NUMBER | DESCRIPTION                             | NUMBER | DESCRIPTION                          |
|--------|---|--------|--------------------------------------|
| 2001   | Main Generator = xxxxx Volts            | 2019   | TM #4 Current = xxxx Amps            |
| 2002   | Main Generator = xxxxx Amps             | 2020   | TM #5 Current = xxxx Amps            |
| 2003   | Input For Traction = xxxxx HP (Kw)      | 2021   | TM #6 Current = xxxx Amps            |
| 2004   | Auxiliary Load = xxxxx HP (Kw)          | 2022   | TM #1 Speed = xxx.x MPH (KPH)        |
| 2005   | Diesel Engine Speed = xxxxx RPM         | 2023   | TM #2 Speed = xxx.x MPH (KPH)        |
| 2006   | Exhauster Speed = xxxxx RPM             | 2024   | TM #3 Speed = xxx.x MPH (KPH)        |
| 2007   | Load Control Pot = xxx%                 | 2025   | TM #4 Speed = xxx.x MPH (KPH)        |
| 2008   | Governor Piston Gap = x.xxx Inches (cm) | 2026   | TM #5 Speed = xxx.x MPH (KPH)        |
| 2009   | Brake Control (TL 24) = xxx%            | 2027   | TM #6 Speed = xxx.x MPH (KPH)        |
| 2010   | Dyn. Brk. TM Field = xxxxx Amps         | 2028   | Battery = xxx Volts                  |
| 2011   | Traction Motor Avg. = xxxxx Amps        | 2029   | Battery Charger = xxxxx Amps         |
| 2012   | Main Gen. Gnd. Leakage = xxxxx mA       | 2030   | Main Generator Field = xxxx Amps     |
| 2013   | Grid Blower #1 = xxxxx RPM              | 2031   | Aux. Alternator Field = xxxx Amps    |
| 2014   | Grid Blower #2 = xxxxx RPM              | 2032   | Horsepower Deration = xxx%           |
| 2015   | Air Compressor Speed = xxxxx RPM        | 2033   | TM Speed; 2nd Active Axle = xxxx RPM |
| 2016   | TM #1 Current = xxxx Amps               | 2034   | Max. Acceleration = xx.xx MPH/Sec    |
| 2017   | TM #2 Current = xxxx Amps               | 2035   | Min. Acceleration = xx.xx MPH/Sec    |
| 2018   | TM #3 Current = xxxx Amps               |        |                                      |



TABLE 3 (Cont'd)

| NUMBER | DESCRIPTION                            | NUMBER | DESCRIPTION                           |
|--------|--|--------|---------------------------------------|
| 2036   | TM#1 Acceleration = xx.xx MPH/Sec      | 2074   | Receive Errors From CAB = xxxxx       |
| 2037   | TM#2 Acceleration = xx.xx MPH/Sec      | 2075   | Aux. Alternator Output = xxxx Volts   |
| 2038   | TM#3 Acceleration = xx.xx MPH/Sec      | 2076   | CAB Mode Command To EXC = xx Hex      |
| 2039   | TM#4 Acceleration = xx.xx MPH/Sec      | 2077   | EXC Mode Reply To CAB = xx Hex        |
| 2040   | TM#5 Acceleration = xx.xx MPH/Sec      | 2078   | Notch Call From CAB = xx Hex          |
| 2041   | TM#6 Acceleration = xx.xx MPH/Sec      | 2079   | TM's Cutout By Cab = 00000000         |
| 2042   | PC Trainline = xx.x Volts              | 2080   | Misc. CAB Commands = 00000000         |
| 2043   | Main Rectifier = xxxxx Volts           | 2081   | Outside Air Temp. = xxx Deg F (C)     |
| 2044   | Aux. Alt. Output = xxx.x Volts/Hz      | 2082   | Barometric Pressure = xx.x PSIA (kPa) |
| 2045   | Differential TM Speed = xx.x MPH (KPH) | 2083   | Water Temperature = xxx Deg F (C)     |
| 2046   | Any TM Overspeed = False               | 2084   | Oil Temperature = xxx Deg F (C)       |
| 2047   | Wheelslide Sand Call = False           | 2085   | SSERPNAME = xxx                       |
| 2048   | Wheelslide Call For Stage 3 = False    | 2086   | Misc. EXC Data = 00000000             |
| 2049   | Wheelslide Call For Stage 4 = False    | 2087   | Max Notch EXC Is Allowing = xx Hex    |
| 2050   | Locked Axle = False                    | 2088   | Battery Charger On? = True            |
| 2051   | Loco. Overspeed = False                | 2089   | Aux. Alt. On? = True                  |
| 2052   | Sanding Is = False                     | 2090   | Number Of Active TM's = xx            |
| 2053   | WSH Trip = False                       | 2091   | Diameter (2nd Axle) = xx.xx In. (cm)  |
| 2054   | WSR Trip = False                       | 2092   | Contactor Errors = 00000000 00000000  |
| 2055   | Wheelslip System Calibrated = True     | 2093   | Input A = 00000000 00000000           |
| 2056   | Maximum TM Current = xxxxx Amps        | 2094   | Input B = 00000000 00000000           |
| 2057   | Total All TM Armature = xxxxx Amps     | 2095   | Output A = 00000000 00000000          |
| 2058   | Maximum Axle Power = xxxxx HP/Axle     | 2096   | Output B = 00000000                   |
| 2059   | Average Power Reference = xxx HP/Axle  | 2097   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2060   | DB Power Call (TM Arm.) = xxx.xx%      | 2098   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2061   | DB Power Call (TM Field) = xxx.xx%     | 2099   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2062   | Wheelslide Deration = xxx.xx%          | 2100   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2063   | Hot TM Deration = xxx.xx%              | 2101   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2064   | Avg Traction Power = xxxxx HP/Axle     | 2102   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2065   | Alt. Fld. Ref. (ICALL) = xxx.xx%       | 2103   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2066   | Air Comp. Mag. Valve (CMV) = True      | 2104   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2067   | Pressure Switch (CGS1) = True          | 2105   | NOT REQ'D FOR TROUBLESHOOTING         |
| 2068   | Pressure Switch (CGS2) = True          | 2106   | DB; Max Arm I Allowed = xxx Amps      |
| 2069   | Air Comp. Air Dryer (EAD) = False      | 2107   | DB Max Field I Allowed = xxx Amps     |
| 2070   | Main Generator On? = True              | 2108   | Max. Arm I Allowed = xxx Amps         |
| 2071   | EXC Mode Restrictions = 00000000       | 2109   | Max. Volts Allowed = xxx Volts        |
| 2072   | EXC Processor Utilization = xxx%       | 2110   | Max. Arm I; Hot TM = xxx Amps         |
| 2073   | Transmissions From CAB = xxxxx         | 2111   | NOT REQ'D FOR TROUBLESHOOTING         |



TABLE 3 (Cont'd)

| NUMBER | DESCRIPTION                            | NUMBER | DESCRIPTION                          |
|--------|--|--------|--------------------------------------|
| 2112   | NOT REQ'D FOR TROUBLESHOOTING          | 2147   | Blwr Heat Count = xxxxx Kill @ 12000 |
| 2113   | Air/Fuel Ratio = xxx.xx                | 2148   | EXC Software Version = xxx.xx        |
| 2114   | NOT REQ'D FOR TROUBLESHOOTING          | 2149   | Motor Axle Input Errors = xxxxx      |
| 2115   | TM#1 Offset Current = xxxxx Amps       | 2150   | Flash Detection Input = xxx.x Volts  |
| 2116   | TM#2 Offset Current = xxxxx Amps       | 2151   | Flashover Trip Counts = xxxxx        |
| 2117   | TM#3 Offset Current = xxxxx Amps       | 2152   | TM#7 Current = xxxxx Amps            |
| 2118   | TM#4 Offset Current = xxxxx Amps       | 2153   | TM#8 Current = xxxxx Amps            |
| 2119   | TM#5 Offset Current = xxxxx Amps       | 2154   | TM#7 Offset Current = xxxxx Amps     |
| 2120   | TM#6 Offset Current = xxxxx Amps       | 2155   | TM#8 Offset Current = xxxxx Amps     |
| 2121   | TM Fld Offset Current = xxxxx Amps     | 2156   | TM#7 Speed = xxx.x MPH (KPH)         |
| 2122   | Main Gen. Offset Current = xxx Amps    | 2157   | TM#8 Speed = xxx.x MPH (KPH)         |
| 2123   | BFR Duty Cycle = xxxxx 0 Kill @ 400    | 2158   | TM#7 Acceleration = xx.xx MPH/Sec    |
| 2124   | AFR Duty Cycle = xxxxx 0 Kill @ 300    | 2159   | TM#8 Acceleration = xx.xx MPH/Sec    |
| 2125   | BRP Duty Cycle = xxxxx 0 Kill @ 300    | 2160   | TM 1 Commutator = xxx Deg C          |
| 2126   | ABC Duty Cycle = xxxxx 0 Kill @ 9900   | 2161   | TM 2 Commutator = xxx Deg C          |
| 2127   | Main Gen. Efficiency = xx.x%           | 2162   | TM 3 Commutator = xxx Deg C          |
| 2128   | NOT REQ'D FOR TROUBLESHOOTING          | 2163   | TM 4 Commutator = xxx Deg C          |
| 2129   | NOT REQ'D FOR TROUBLESHOOTING          | 2164   | TM 5 Commutator = xxx Deg C          |
| 2130   | NOT REQ'D FOR TROUBLESHOOTING          | 2165   | TM 6 Commutator = xxx Deg C          |
| 2131   | NOT REQ'D FOR TROUBLESHOOTING          | 2166   | TM 7 Commutator = xxx Deg C          |
| 2132   | NOT REQ'D FOR TROUBLESHOOTING          | 2167   | TM 8 Commutator = xxx Deg C          |
| 2133   | Adhesion Percentage = xx.xx %          | 2168   | High Speed Voltage Lim = xxx Volts   |
| 2134   | NOT REQ'D FOR TROUBLESHOOTING          | 2169   | HEP Restrictions = 00000000          |
| 2135   | Sanding Due To Low HP = True           | 2170   | HEP Permissions = 00000000           |
| 2136   | Blwr; High Phase Current = xxx Amps    | 2171   | BLENDED BRAKE CALL = xxx.x%          |
| 2137   | Blwr; Low Phase Current = xxx Amps     | 2172   | DYNAMIC BRK. EFFORT = xxxxx Lbs      |
| 2138   | Fan High Phase Current = xxx Amps      | 2173   | DYNAMIC BRK. REFERENCE = xxxxx Lbs   |
| 2139   | Fan Low Phase Current = xxx Amps       | 2174   | Blended Brake = False                |
| 2140   | Man Sand Limit Setting = xxx MPH (KPH) | 2175   | Emergency Blended Brake = False      |
| 2141   | False EXC Interrupts = xxxxx Counts    | 2176   | SDPP status signal = xx.xx Volts     |
| 2142   | B-Field Regulator Status = 00000000    | 2177   | HEP Voltage = xxxxx Volts            |
| 2143   | B-Field Regulator Commd = 00000000     | 2178   | Preturbine Left Port = xxx Deg. F    |
| 2144   | Battery Regulator Status = 00000000    | 2179   | Preturbine Right Port = xxx Deg. F   |
| 2145   | Battery Regulator Commd = 00000000     | 2180   | Equipment Blower Speed = xxxxx RPM   |
| 2146   | Fan Heat Count = xxxxx Kill @ 12000    | 2181   | Dynamic Brake/WS Status = 00000000   |



**TABLE 4. AUX MONITOR PARAMETER NUMBERS (3000 Series).**

| NUMBER | DESCRIPTION                                       | NUMBER | DESCRIPTION                                |
|--------|---|--------|--|
| 3001   | Intake Air Manifold = xxx PSI (kPa)               | 3043   | Output A = 00000000 00000000               |
| 3002   | Barometric Pressure = xx.x PSI (kPa)              | 3044   | Output B = 00000000 00000000               |
| 3003   | Engine Outlet Water = xxx Deg. F (C)              | 3045   | CAB Transmissions To AUX = xxxxx           |
| 3004   | Engine Outlet Lube Oil = xxx Deg. F (C)           | 3046   | Receive Errors From CAB = xxxxx            |
| 3005   | Hottest TM Temperature = xxx Deg. C               | 3047   | Blower/Fan/Aircomp = xxxx HP (Kw)          |
| 3006   | SPARE = xxx                                       | 3048   | Ignore Inputs A = 00000000 00000000        |
| 3007   | Crankcase Over Press. = xx.x In. H <sub>2</sub> O | 3049   | Ignore Inputs B = 00000000 00000000        |
| 3008   | Blower/Fan Time Delay = xxxxx mS                  | 3050   | Ignore Inputs C = 00000000 00000000        |
| 3009   | Blwr/Fan Overrides; CAB = 00000000                | 3051   | Ignore Inputs D = 00000000 00000000        |
| 3010   | BrainLine In Use To CAB = xxxxxx                  | 3052   | CT's Out Of Limits = xxxx Hex              |
| 3011   | AUXLINE In Use; EBP, RFP = xxx                    | 3053   | Data A From Blower = xxxx Hex              |
| 3012   | BrainLine Errors = xxxxx Errors                   | 3054   | Data B From Blower = xxxx Hex              |
| 3013   | AUXLINE Errors = xxxxx Errors                     | 3055   | Data A To Blower = xxxx Hex                |
| 3014   | Last Sensor Data = xxxxx                          | 3056   | Data B To Blower = xxxx Hex                |
| 3015   | Channel Gain = xxxxx                              | 3057   | Data A From Fan = xxxx Hex                 |
| 3016   | Channel Offset = xxxxx                            | 3058   | Data B From Fan = xxxx Hex                 |
| 3017   | Hottest TM Field Temp. = xxx Deg C                | 3059   | Data A To Fan = xxxx Hex                   |
| 3018   | Hottest TM Core Temp. = xxx Deg C                 | 3060   | Data B To Fan = xxxx Hex                   |
| 3019   | Steady State TM Arm. = xxx Deg. C                 | 3061   | Water Solenoid = True                      |
| 3020   | Steady State TM Fld. = xxx Deg. C                 | 3062   | Latest Selftest Commanded = xxxx Hex       |
| 3021   | Blower Spd Call; MTP = xx Hex                     | 3063   | Latest Selftest Run = xxxx Hex             |
| 3022   | Blower Spd Call; Arm. = xx Hex                    | 3064   | Time CPU Is 100% Busy = xxxxx              |
| 3023   | Blower Spd Call; Fld. = xx Hex                    | 3065   | Traction Motor Air Flow = xxxx CFM (DAL/m) |
| 3024   | Blower Spd Call; Pred. Temp = xx Hex              | 3066   | TM Volts Per RPM = xxx mV/RPM              |
| 3025   | Brake Pipe Pressure = xxx PSI (kPa)               | 3067   | AUXLINE Error Counts = xxxxx               |
| 3026   | Independent Brake Pipe = xxx PSI (kPa)            | 3068   | CAB Mode Command To AUX = xx Hex           |
| 3027   | Blower/Fan Spd. Commands=00000000                 | 3069   | TM Speed; 2nd Active Axle = xxxx RPM       |
| 3028   | Misc. Data; EXC To AUX = 00000000                 | 3070   | Highest TM Armature = xxxx Amps            |
| 3029   | Misc. Data; CAB To AUX = 00000000                 | 3071   | TM Field Current = xxxx Amps               |
| 3030   | AUX Mode Restrictions = 00000000                  | 3072   | Diesel Engine Speed = xxxx RPM             |
| 3031   | Input Buffer A; AUXLINE = xxxx Hex                | 3073   | TM Temperature Deration = xxx.xx%          |
| 3032   | Input Buffer B; AUXLINE = xxxx Hex                | 3074   | AUX Mode Reply To CAB = xx Hex             |
| 3033   | Output Buffer A; AUXLINE = xxxx Hex               | 3075   | Throttle Call = xx Hex                     |
| 3034   | Output Buffer B; AUXLINE = xxxx Hex               | 3076   | AUX Processor Utilization = xxx%           |
| 3035   | Req'd. Input A = 00000000 00000000                | 3077   | AUX Trying For Mode = xx Hex               |
| 3036   | Actual Input A = 00000000 00000000                | 3078   | Blower 1 Load = xxx HP (Kw)                |
| 3037   | Req'd. Input B = 00000000 00000000                | 3079   | Blower 2 Load = xxx HP (Kw)                |
| 3038   | Actual Input B = 00000000 00000000                | 3080   | Alt. Blower Load = xxx HP (Kw)             |
| 3039   | Req'd. Input C = 00000000 00000000                | 3081   | EOT Brake Pipe = xxx PSIG (kPa)            |
| 3040   | Actual Input C = 00000000 00000000                | 3082   | Fan Load = xxxxx HP (Kw)                   |
| 3041   | Req'd. Input D = 00000000 00000000                | 3083   | Air Compressor Load = xxxxx HP (Kw)        |
| 3042   | Actual Input D = 00000000 00000000                |        |  |



TABLE 4 (Cont'd)

| NUMBER | DESCRIPTION   | NUMBER | DESCRIPTION                             |
|--------|---|--------|---|
| 3084   | Blower Duty Cycle = xxxx Kill @ 9900                    | 3106   | AUX Compt. Air Temp. = xxx Deg. F (C)   |
| 3085   | False AUX Interrupts = xxxx                             | 3107   | Output C = 00000000                     |
| 3086   | Fan Duty Cycle = xxxx Kill @ 9900                       | 3108   | Output Buffer C; AUXLINE = xxxx Hex     |
| 3087   | Current Transformer 1 = xx.x Volts                      | 3109   | Output C = 00000000 00000000            |
| 3088   | Current Transformer 2 = xx.x Volts                      | 3110   | Req'd. Input E = 00000000 00000000      |
| 3089   | Current Transformer 3 = xx.x Volts                      | 3111   | Actual Input E = 00000000 00000000      |
| 3090   | Current Transformer 4 = xx.x Volts                      | 3112   | Ignore Inputs E = 00000000 00000000     |
| 3091   | Current Transformer 5 = xx.x Volts                      | 3113   | Commutator Temperature = xxx Deg. C     |
| 3092   | Current Transformer 6 = xx.x Volts                      | 3114   | Road Number = xxxxx                     |
| 3093   | Current Transformer 7 = xx.x Volts                      | 3115   | AUX Time; Seconds = xx                  |
| 3094   | Current Transformer 8 = xx.x Volts                      | 3116   | AUX Time; Minutes = xx                  |
| 3095   | Current Transformer 9 = xx.x Volts                      | 3117   | AUX Time; Hours = xx                    |
| 3096   | AUX Software Version = xxx.xx                           | 3118   | AUX Time; Day Of Week= x [1=Sunday]     |
| 3097   | Equip. Blower 1 Pres. = xx.x In. H <sub>2</sub> O (kPa) | 3119   | AUX Time; Day Of Month = xx             |
| 3098   | Equip. Blower 2 Pres. = xx.x In. H <sub>2</sub> O (kPa) | 3120   | AUX Time; Month = xx [1 = January]      |
| 3099   | NOT REQ'D FOR TROUBLESHOOTING                           | 3121   | AUX Time; Year = xxxx                   |
| 3100   | NOT REQ'D FOR TROUBLESHOOTING                           | 3122   | Outside Air Temp. = xxx Deg. F (C)      |
| 3101   | NOT REQ'D FOR TROUBLESHOOTING                           | 3123   | #16 Pipe Pressure = xxx Psig (kPa)      |
| 3102   | NOT REQ'D FOR TROUBLESHOOTING                           | 3124   | TA Stator Temp. = xxx Deg. C            |
| 3103   | NOT REQ'D FOR TROUBLESHOOTING                           | 3125   | Intercooler Water Temp = xxxx Deg. F(C) |
| 3104   | NOT REQ'D FOR TROUBLESHOOTING                           | 3126   | Cooling Status = 00000000 00000000      |
| 3105   | NOT REQ'D FOR TROUBLESHOOTING                           |        |   |



TABLE 5. HEP MONITOR PARAMETER NUMBERS (5000 Series).

| NUMBER | DESCRIPTION                        | NUMBER | DESCRIPTION                         |
|--------|------------------------------------|--------|-------------------------------------|
| 5001   | HEP Voltage = xxxxx Volts          | 5028   | Misc. CAB Commands = 00000000       |
| 5002   | HEP Average Current = xxxxx Amps   | 5029   | CAB Restrictions = 00000000         |
| 5003   | HEP Load = xxxxx HP                | 5030   | HEP Status = 00000000 00000000      |
| 5004   | Diesel Engine Speed = xxxxx RPM    | 5031   | Misc. EXC Data = 00000000           |
| 5005   | Load Control Pot = xxx %           | 5032   | Max. Notch HEP Is Allowing = xx Hex |
| 5006   | Main Generator = xxxx Amps         | 5033   | Redundant Batt Charger Off = True   |
| 5007   | SPARE Not Used Yet                 | 5034   | HEP Alternator On = True            |
| 5008   | Blended Brake Output = xx.xx Volts | 5035   | HEP Regulator Status = 00000000     |
| 5009   | Blended Brake Fdbk = xx.xx Volts   | 5036   | HEP Regulator Command = 00000000    |
| 5010   | Battery = xxx Volts                | 5037   | HEP OFF = False                     |
| 5011   | HEP Alternator Field = xxxx Amps   | 5038   | HEP NORMAL = False                  |
| 5012   | HEP Phase A-GND = xxxxx Volts      | 5039   | HEP STANDBY = False                 |
| 5013   | HEP Phase B-GND = xxxxx Volts      | 5040   | HEP WAYSIDE = False                 |
| 5014   | HEP Phase C-GND = xxxxx Volts      | 5041   | HEP MA = False                      |
| 5015   | HEP Phase A Current = xxxx Amps    | 5042   | No TVR Volts = False                |
| 5016   | HEP Phase B Current = xxxx Amps    | 5043   | TCLR = False                        |
| 5017   | HEP Phase C Current = xxxx Amps    | 5044   | TCRR = False                        |
| 5018   | HEP Output = xxx.x Volts/Hz        | 5045   | HEP 'On' Call = False               |
| 5019   | HEP Mode Restriction A = 00000000  | 5046   | SPARE Not Used Yet                  |
| 5020   | HEP Mode Restriction B = 00000000  | 5047   | Input A = 00000000 00000000         |
| 5021   | HEP Processor Utilization = xxx %  | 5048   | Input B = 00000000 00000000         |
| 5022   | Transmissions from CAB = xxxxx     | 5049   | SPARE Not Used Yet                  |
| 5023   | Receive Errors from CAB = xxxxx    | 5050   | Input D = 00000000 00000000         |
| 5024   | CAB Mode Command to HEP = xx Hex   | 5051   | Output A = 00000000 00000000        |
| 5025   | HEP Mode Reply to CAB = xx Hex     | 5052   | Output B = 00000000 00000000        |
| 5026   | Notch Call from CAB = xx Hex       | 5053   | Output C = 00000000                 |
| 5027   | TM's Cutout by CAB = 00000000      | 5054   | HEP Software Version = xxx.xx       |







New York Air Brake Corporation

## CLEARING FAULTS



New York Air Brake Corporation

## CLEARING FAULTS



New York Air Brake Corporation  
A Knorr Brake Company

## **CLEARING FAULTS**

(Amtrak & Metro North)

The Electronic Braking System will detect "*Air Brake Faults*"  
Some of these faults may have occurred during set up.  
Clear faults as follows:

1. Secure locomotive.
2. Close end cocks and angle cocks, including M.R. Line.
3. Verify Air Brake Computer (CCB) circuit breaker is CLOSED and remove Reverser handle.
4. Move L/T switch to TRAIL.  
**NOTE:** If unit will not go to TRAIL, move L/T switch to LEAD. Then try step 4 again.
5. Place Auto in EMERGENCY.
6. Place Ind in RELEASE.
7. After 60 seconds, place Auto in RELEASE.
8. Move L/T switch to LEAD-CUT IN and charge B.P. to 110 psi.
9. Place Auto in SUPPRESSION for 10 seconds.
10. Return Auto to RELEASE. Allow ER & BP to fully charge and BC to go to 0 psi.
11. Place Ind in FULL APPLICATION for 15 sec.
12. Place Ind in RELEASE.
13. Actuate Bail Off ring for 10 seconds.
14. Place Auto handle in EMERGENCY.
15. After 60 seconds, place Auto in RELEASE.
16. Place Ind in FULL APPLICATION.
17. Faults should be cleared. If faults do not clear, follow Message Instruction on IFD.

## **OPERATING NOTES**

(Amtrak & Metro North)

- NOTE 1:** The Electronic Air Brake System will detect an *Air Brake Fault* if two (2) or more units are in the LEAD-CUT IN or LEAD-CUT OUT mode at the same time. Verify other MU locomotives are in TRAIL prior to cutting lead locomotive into LEAD.
- NOTE 2:** DO NOT turn off breaker for Computer Controlled Brake (CCB), unless locomotive is to be used as a DEAD unit.
- NOTE 3:** If less than normal full B.C. pressure is obtained when Ind is in Full Application position, ensure that Application Pipe cut-out cocks on all unused hoses are fully closed.
- NOTE 4:** When a Penalty Application occurs, E.R. & B.P. reduce to psi. When an Emergency Application occurs, B.P. & E.R. reduce to 0 psi.



New York Air Brake Corporation  
A Knorr Brake Company  
(Amtrak & Metro North)

| FAULT CODE |      | DESCRIPTION                        | MODE |
|------------|------|------------------------------------|------|
| NYAB       | GE   |                                    |      |
| 1          |      | ROM - Not displayed on IFD         |      |
| 2          |      | RAM - Not displayed on IFD         |      |
| 10         | 245E | Brake Vlv/FOR - No Bv Release      | P    |
| 11         | 245F | Brake Vlv/SS8 - No Bv Release      |      |
| 12         | 2460 | Brake Vlv/SS8 - No Bv Emer Error   | A    |
| 13         | 2461 | Brake Vlv/FOR - Improper Auto      |      |
| 14         | 2462 | Brake Vlv/SS8 - No Rel Verify      |      |
| 15         | 2463 | Brake Vlv/SS8 - No Emer Verify     |      |
| 20         | 2468 | Brake Vlv/FOR - Ind Max From Rel   |      |
| 21         | 2469 | Brake Vlv/SS8 - Ind Max Only       |      |
| 22         | 246A | Brake Vlv/SS8 - Ind Max Only       |      |
| 23         | 246B | Brake Vlv/FOR - Improper Ind App   |      |
| 24         | 246C | Brake Vlv/SS8 - No Bail Off        |      |
| 25         | 246D | Brake Vlv/SS8 - No Max Ind Verify  |      |
| 26         | 246E | Brake Vlv/SS8 - No Rel Ind Verify  |      |
| 28         | 2470 | AW4-ER/EPA1 - Improper ER psi      |      |
| 29         | 2471 | Brake Vlv/SS8 - Improper Mode      |      |
| 30         | 2472 | PS-BP/BEA - Switch Stuck Closed    |      |
| 31         | 2473 | PS-BP/BEA - Switch Stuck Open      |      |
| 32         | 2474 | MV53/DB1/EPA1 - ER 0 Psi Default   |      |
| 34         | 2476 | AW4-ER/EPA1 - No ER supply         | P    |
| 35         | 2477 | MVER/DB1/EPA1-ER 0 Psi Default     | P    |
| 36         | 2478 | BP-CO/BEA - No BP Cut Off          |      |
| 38         | 247A | AW4-ER/EPA1 - No ER Exhaust        | P    |
| 40         | 247C | AW4-16/EPA2 - No BC Supply         | B    |
| 41         | 247D | AW4-16/EPA2 - No BC Exhaust        | B    |
| 42         | 247E | MV16T/DB1/EPA2 - Brk Back Up       | B    |
| 43         | 247F | PS-13/BEA - No BC Bail Off         |      |
| 44         | 2480 | 20CP-Adjust Regulator              |      |
| 46         | 2482 | DB10-No Back Up Default BC         |      |
| 47         | 2483 | PS13/BEA - No BC Bail Off          |      |
| 48         | 2484 | PS13/MV13S/BEA - No Bail Off       |      |
| 49         | 2485 | PS13/MV13E/BEA - Slow Bail Exhaust |      |
| 51         | 2487 | MRT/AD - No MR Trans               |      |
| 52         | 2488 | BTP/AD - No BP Trans               | P&B  |
| 54         | 248A | ERT/Ad - No ER Trans               |      |
| 55         | 248B | BCT/AD - No BC Trans               |      |
| 56         | 248C | 16T/AD - No BC Control Trans       |      |
| 57         | 248D | 20T/AD - No Ind Trans              |      |
| 60         | 2490 | AD - No Trans                      |      |
| 61         | 2491 | MVEM/EPA1/PVEM - No Elect Emer     |      |
| 62         | 2492 | ELV - Adjustment Required          |      |
| 71         | 249B | SS9 - Continuous Bail Off (Bg TI)  |      |
| 72         | 249C | SS9 -No Alerter Input Or Cut Off   |      |
| 76         | 24AO | 20P/DB1/BEA - No Ind Supply        |      |
| 78         | 24A2 | 20P/DB1/BEA - No Ind Release       |      |
| 79         | 24A3 | 20P/DB1/BEA -Ind Exhaust Open      |      |
| 80         | 24A4 | Comm - No IFC Receive              |      |
| 90         | 24AE | Brake Viv Self Test Fault          |      |
| 91         | 24AF | ER control Self Test Fault         |      |
| 92         | 24BO | BP Self Test Fault                 |      |
| 93         | 24B1 | Independent Self Test Fault        |      |
| 94         | 24B2 | Bail Off Self Test Fault           |      |
| 95         | 24B3 | BC Self Test Fault                 |      |
| 96         | 24B4 | Locomotive I/O Self Test Fault     |      |

P = Penalty, A = Alarm, B = Backup

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## TROUBLESHOOTING GUIDE

PARSONS CRANE LIFT SYSTEMS  
MANUAL RELEASE







# PARKING BRAKE TROUBLESHOOTING TABLE

Begin with LINE 1 and follow instructions through the table.

| LINE | QUESTION   | YES   | NO  |
|------|--|---|---|
| 1.   | Is parking brake valve in operator's cab in the RELEASE position?            | Proceed to LINE 2.  | Turn parking brake valve to RELEASE position. If problem still exists, proceed to LINE 2.   |
| 2.   | Does IFD Screen display message "Warning! Parking Brake Applied" ?           | Reset IFC (reboot) using procedure in P-42 Operator's Manual, page 101. If problem still exists, proceed to LINE 3. | Proceed to LINE 3.  |
| 3.   | Is main reservoir air available?   | Proceed to LINE 5.  | Properly M.U. locomotives and charge main reservoir. If problem still exists, go to LINE 5. If main reservoir air is NOT available due to damage or missing hoses or locomotive is dead in train (ONLY Brake Pipe air is available) then Proceed to LINE 4. |
| 4.   | Is available brake pipe pressure at least 90 psi?                            | Proceed to LINE 7.  | Proceed to LINE 8   |
| 5.   | Are parking brake cut-out cocks (2) on engineer's side of locomotive cut in? | Proceed to LINE 6.  | Cut in parking brake cut-out cocks on engineer's side of locomotive. If problem still exists, proceed to LINE 6.  |
| 6.   | Is auxiliary air cut-out cock cut in?  | Proceed to LINE 8.  | Cut in auxiliary air cut-out cock on engineer's side of locomotive. If problem still exists, proceed to LINE 8.   |
| 7.   | Is the dead engine feature (dead-in-tow cut out cock) cut-in?                | Proceed to LINE 8.  | Cut in dead engine feature. For more information on cutting in dead engine feature, see appropriate operator's manual. If problem still exists, proceed to LINE 8.  |
| 8.   | PARKING BRAKE UNITS MUST BE MANUALLY RELEASED.                               |   |   |



|  |  |  |  |
|--|--|--|--|
|  | CAUTION: If you manually release the parking brake when locomotive main reservoir system has been depleted, the locomotive WILL NOT HAVE ANY BRAKES. Be certain that wheels are chocked and unit properly secured before manually releasing the parking brake. |  |  |
|  | To manually release the parking brake units, proceed with the following instructions.  |  |  |
|  | A. Secure locomotive (chock wheels, etc.)  |  |  |
|  | B. Place parking brake handle in cab of locomotive in the APPLIED position.  |  |  |
|  | C. Use wrench from tool box in rear of locomotive to mechanically unlatch the 8 parking brake units. A 9/16" or 14mm open-end wrench will also work.   |  |  |
|  | D. To mechanically unlatch the parking brake units, turn the square release nut on each brake unit toward the brake shoe approximately 1/4 turn and hold until the shoe is released from wheel.  |  |  |
|  | E. Be sure to leave the parking brake handle in the cab of the locomotive in the APPLIED position.   |  |  |
|  | F. To reset the parking brake manual release mechanism, at least 90psi main reservoir pressure must be available. Also, when the dead engine feature is cut in, brake pipe pressure of at least 90psi will reset the release mechanism.                        |  |  |
|  | G. To reset the parking brake manual release mechanism, turn the parking brake handle in the cab to the RELEASED position then back to APPLIED position.   |  |  |

## GE-2. IFD SCREENS (dark screens, invalid values, etc.) (P-40, P-42, P-32 DM):

In the event of an IFD screen failure, screens display invalid or out of range values or locomotive loading problems, the IFC computer can be reset (rebooted) by performing the following procedure:



**CAUTION:** If the Battery Charge and Computer circuit breaker is turned off (OPENED) on the LEAD unit while the train is in motion, a Penalty Brake (full service) application will occur. In addition, if unit is LEAD or TRAIL unit in consist, power is dropped.

1. Stop train/locomotive and properly secure.
2. Turn off (OPEN) the Battery Charge and Computer circuit breaker on the engine control panel.
3. Wait 5 seconds.
4. Turn on (CLOSE) the Battery Charge and Computer circuit breaker on the engine control panel.
5. Wait until the computer reboots and the IFD screens are displayed again.

Note: If the problem still exists after following the above procedure, perform the steps again. However, in step 3, extend the wait period for 30 seconds.

### **GE-3. ELECTRONIC AIR BRAKE TROUBLESHOOTING (PCS OPEN) (P-42,P-32 DM) :**

**Caution:** Before beginning E-Brake troubleshooting procedures, stop train/locomotive and properly secure. If the Battery Charge and Computer circuit breaker or the Air Brake Computer circuit breaker is turned off (OPENED) on the LEAD unit while the train is in motion, a Penalty Brake (full service) application will occur.

- I. Unit loads (possibly accompanied by "Slip/Axle Warn" light):

Reset (Reboot) IFC computer as follows:

1. Stop train/locomotive and properly secure.
2. Turn off (OPEN) the Battery Charge and Computer circuit breaker on the engine control panel.
3. Wait 5 seconds.



4. Turn on (CLOSE) the Battery Charge and Computer circuit breaker on the engine control panel.
5. Wait until the computer reboots and the IFD screens are displayed again.

Note: If the problem still exists after following the above procedure, perform the steps again. However, in step 3, extend the wait period for 30 seconds.

## II. Locomotive won't load (PCS OPEN):

### A. LEAD UNIT

1. Follow instructions on IFD screen (Air brake message area) if any. If PCS will not recover, go to step 2 below.
2. Reset (reboot) E-Brake as follows:
  - a) Stop train/locomotive and properly secure.
  - b) Turn off (OPEN) the Air Brake Computer circuit breaker on the engine control panel.
  - c) Wait 5 seconds.
  - d) Turn on (CLOSE) the Air Brake Computer circuit breaker on the engine control panel.
  - e) Move the Automatic Brake Valve Handle to SUPPRESSION and follow the instructions on the IFD screen.
3. If after following the above procedure, the brake system (PCS) still cannot be recovered, proceed as follows:
  - a) Turn off (OPEN) the Air Brake Computer circuit breaker on the engine control panel.
  - b) Turn off (OPEN) the Battery Charge and Computer circuit breaker on the engine control panel.
  - c) Wait 5 seconds.
  - d) Turn on (CLOSE) the Battery Charge and Computer circuit breaker on the engine control panel.



e) Wait until the computer reboots and the IFD screens are displayed again.

f) Turn on (CLOSE) the Air Brake Computer circuit breaker on the engine control panel.

g) Move the Automatic Brake Valve Handle to SUPPRESSION and follow the instructions on the IFD screen.

**B. TRAILING UNIT**

1. Move Brake Valve Cut-off Pilot switch to "TEST" position for 30 seconds. If PCS will not recover, go to step 2 below.

2. Set up the lead unit for TRAIL.

3. Set up the suspected trailing unit for LEAD.

4. Use the procedures above for LEAD UNIT to attempt PCS recovery.

5. After PCS recovery has been accomplished, set units back up to original LEAD and TRAIL configurations.

**C. CANNOT RECOVER PCS ON E-BRAKE AFTER FOLLOWING ABOVE INSTRUCTIONS**

1. The Air Brake Computer circuit breaker on the engine control panel should be turned off (OPEN) and left off.

2. The unit MUST be operated as a trailing unit. The NYAB/KNORR air brake system will operate in "back-up" mode with the Air Brake Computer circuit breaker turned off. The maximum brake cylinder pressure available in "back-up" mode is 45 psig. In addition, unit in "back-up" mode will not load.

3. Bail off of any brake cylinder pressure from an automatic brake application requires a minimum of 8 seconds per unit in "back-up" mode.

**GE-4. UNIT WILL NOT CRANK (ROTATE) AFTER BEING SHUT DOWN (P-32,P-40,P-42,P-32DM):**



Before attempting to crank any Amtrak General Electric locomotive, make certain that the MU Emergency shutdown push-button on the engineer's console is in the RUN position and the Battery Connect Push-button (BCPB) on the engine control panel has been pressed.

## GE-5. UNIT WON'T LOAD - DEFECTIVE SPEED SENSOR (P-32, P-40, P-42, P-32 DM) :

If a defective speed sensor is suspect in preventing the locomotive from loading, proceed as follows:

1. From IFD screen number 000000 or from the DID panel, press the SHOW MORE and/or GO BACK function keys to review any summary messages which are displayed.
  - a). If either "Won't Load: Locked Axle Detected" or "Won't Load: Fault Message Stored" summary message is displayed, go to IFD screen number 600000 by pressing the RESET FAULTS function key.
  - b). Using the function keys at IFD screen number 600000 or from the DID panel, scroll through the fault codes and note the numbers. Use the following codes to help you locate which speed sensor is defective.

| FAULT CODE | CORRESPONDING TRACTION MOTOR SPEED SENSOR NUMBER |
|------------|--|
| 44B3       | 1  |
| 44B9       | 1  |
| 44B4       | 2  |
| 44BA       | 2  |
| 44B5       | 3  |
| 44BB       | 3  |
| 44B6       | 4  |
| 44BC       | 4  |

- c). If no fault codes are displayed on the IFD screen or DID panel or fault codes do not match those listed above, proceed to step 2 below.

2. To cut out the defective speed sensor, break the seal on the speed sensor cut-out switch located on the engine control panel and cut out the switch.



3. Move the Engine Control switch located on the engine control panel to the ISOLATE position.
4. If fault codes are not displayed on IFD screen or DID panel or fault codes do not match those in the table, proceed to step 5.
  - a) Using the fault code table above, cut out the associated traction motor by moving the appropriate traction motor cut-out switch on the engine control panel to the OUT position. (Example: if fault code 44B4 was displayed on the IFD screen or DID panel, cut out the number 2 traction motor.)
  - b) Proceed to step 6 below.
5. Cut out the number 1 traction motor by moving the appropriate traction motor cut-out switch on the engine control panel to the OUT position.
6. Move the Engine Control switch located on the engine control panel to the RUN position.
7. Verify that locomotive loads. If not, cut in and cut out individual traction motors to isolate faulty speed sensor. Each time a traction motor is cut out, attempt to load the locomotive to determine if the faulty speed sensor has been selected.

REMEMBER: THE ONLY WAY TO CUT OUT A SPEED SENSOR IS TO CUT OUT THE SPEED SENSOR CUT-OUT SWITCH AND THE APPROPRIATE TRACTION MOTOR.

8. Ascertain that all wheels are rotating freely before proceeding. Anytime a speed sensor is cut out, locked axle protection is lost on the motor which is cut out.

NOTE: A minimum of two motor speed sensors must be operating for the unit to load.

#### **GE-6. FUEL PRIMING AFTER UNIT RUNS OUT OF FUEL (P-32, P-40, P-42, P-32 DM):**

1. Fill unit with fuel.
2. Place Isolation Switch on Engine Control Panel in START Position



3. If unit has been shut down over 15 minutes, press the Battery Connect Push-button (BCPB) located on the panel below the Engine Control Panel. This reconnects the batteries to the locomotive control system.
4. At the Start Station, located near the engine, turn the Start switch to the PRIME position. Hold until solid flow with no bubbles shows in the sight glass and fuel pressure gauge shows approximately 40-45 psig on P-32/40 locomotives and 50-55 psig on P-42/P-32 DM locomotives. This could take up to two (2) minutes.
5. After holding Start Switch in PRIME position for two (2) minutes and solid flow cannot be obtained in sight glass, continue with the following steps. Otherwise, turn Start switch to START position and hold until the engine starts.
6. Open vent petcock on top of fuel filter housing.
7. Move Engine Start switch to "Fuel Prime" position and hold.
8. Observe fuel and air exhausting from vent petcock on fuel filter housing.
9. Continue holding Engine Start switch in "Fuel Prime" position until all air is exhausted from fuel system. This could take up to 2 minutes (normally no longer than 30 seconds). Note: Engine Start switch has a timer which operates the fuel pump for approximately 10 seconds after switch is moved to the "Fuel Prime" position (fuel pump will continue running after switch is released for 10 seconds).
10. When fuel flows clear from vent petcock, close it.
11. Continue priming until fuel sight glass below Engine Start switch is clear of bubbles. If sight glass does not clear, open vent petcock on fuel filter housing again to expel air. Close vent petcock when air is expelled.
12. Repeat steps as necessary until fuel flows clear in fuel sight glass. Fuel pressure as indicated on gauge above Engine Start switch should read 40-45 psig on P-32/P-40 locomotives and 50-55 psig on P-42/P-32 DM locomotives.
13. Turn the Start Switch to START position and hold until engine starts.



NOTE: If while bleeding air from fuel system, fuel prime stops and will not start again, go to cab and press the Battery Connect Push-button (BCPB).

## GE-7. TRACTION MOTOR SUPPORT BEARING DETECTOR (P-32,P-40,P-42,P-32 DM):

The Hot Support Bearing Detector Box is located inside the electrical cabinet door (CA1) on the fireman's side of the locomotive. It is connected to the 8 traction motor support bearing sensors and to the locomotive computer. If a hot traction motor support bearing is detected by the detector box, the locomotive engineer will see a message on the IFD screen which states either: "Warning! Hot Support Bearing on This Locomotive" or "Warning! Axle Problem On Other Loco". An audio alarm will also sound.

In the event that an overheated support bearing is indicated, the following procedure will apply:

1. Safely stop the train and determine which locomotive is causing the alarm.
2. Determine which support bearing is hot by observing the LED's on the detector box to see which is illuminated and flashing red.
3. Perform a visual inspection of the identified support bearing for failure. This is indicated by smoke, burnt odor, discoloration and/or flames originating from the bearing area. If the support bearing is moist from water or oil and vapor or mist is not observed, the temperature is not critical.
4. If no obvious signs of overheating are present and a question still remains as to the condition of the support bearing, a "FEEL" test may be conducted. Using only your hand, protected with a glove or rag, reach out to lightly brush the support bearing area. If heat is radiating from the support bearing area, the locomotive must be set out at the nearest location in accordance with the following paragraph:

Locomotives with evidence of a failed support bearing must be isolated if possible, or cutout the traction motor circuit to the effected motor. The locomotive should then be moved not to exceed 10 MPH to the next point where the locomotive can be set out. Defect must be noted on the MAP-100.



7. Upon inspection, if nothing is found to indicate a failed support bearing, press the "Alarm Reset" button located at the bottom of the detector box. Reset the fault on the IFD screen. The locomotive may then proceed not exceeding 50 MPH, a distance of at least 10 miles. Then the support bearing must be reinspected

NOTE: After pressing the "Push To Reset" button located on the detector box, the LED which was indicating the hot support bearing will stop flashing and will illuminate continuously. The "Alarm Hot Bearing" light will also turn off.

## **GE-8. EOT SET-UP & ARMING (P-40, P-42):**

The End of Train System includes an End of Train Unit, which is attached to the coupler on the last car in the train and an End of Train Monitor (LCU), which is installed on the locomotive.

In the past, the End of Train Unit was used only to transmit information about brake pipe pressure and last car movement on the rear of the train to the locomotive End of Train Monitor (LCU). With the advent of the 2-Way EOT, the locomotive End of Train Monitor (LCU) can now transmit information to the rear of the train. This 2-way communication allows the locomotive to tell the EOT unit on the rear of the train to apply an emergency brake application.

To set up the EOT system, follow the instructions below.

### **SETUP**

1. Mount the End of Train unit on the last car of the train.
2. Install the End of Train monitor (LCU) in the holder on the door in Control Area 1 of the locomotive. Connect the power and antenna cables to the End of Train monitor (LCU). See page 57 of the P-42 Operator's Manual for installation instructions.
3. After the End of Train monitor (LCU) is properly installed on the locomotive, the EOT system can be set up using the IFD screen. NOTE: The EOT can only be set up using the engineer's side IFD screens.
4. Press the F8 "EXIT" key on the IFD until screen number 000000 or 200000 is displayed. The screen number is located in the small box directly above the F8 key.
5. From either screen 000000 or 200000, press the F3 "Operator Functions" key. Screen 300000 will then be displayed.



6. From screen 300000, press the F3 "EOT Setup" key. Screen 330000 will then be displayed.
7. From screen 330000, press the F1 "Function On/Off" key until the second box above the F1 key displays "EOT ON".
8. Press the F2 "EOT Setup" key. Screen 332000 will then be displayed.
9. Use the F1-F5 (Arrows) keys to enter the End of Train unit ID code. This is the code on the device which is installed on the rear of the train.
10. After the code is correctly set, press the F6 "Enter Code" key.
11. Press the F7 "Comm Test" key. The Comm Test Status box (large box above the F6 key) will display "Comm Test Running".
12. When the Comm Test is finished running, the Comm Test Status box will display either "Comm Test Passed" or "Comm Test Failed".

If the Comm Test failed, make sure you set the correct unit ID code and that the End of Train monitor (LCU) cables are properly installed. Go to step 11 above if comm test failed.

When "Comm Test Passed" is displayed, the unit is ready to arm the 2-Way function.

#### ARMING 2-WAY

The arming of the 2-Way function requires two people, one at the EOT unit at the rear of the train and one at the IFD screen on the locomotive.

1. Instruct the employee at the rear of the train to press the "TEST" button on the EOT unit.
2. When the "TEST" button is pressed, the F7 key on the IFD screen will change from "Comm Test" to "Arm Two Way" and the EOT Status box will display "Arm Now".
3. Immediately press the F7 "Arm Two Way" key. Wait until the F7 key changes back to "Comm Test" and observe the EOT Status box.



If the system successfully armed, the EOT Status box will display "Armed". The EOT system is now Armed and ready.

If the EOT Status box displays "Not Armed", the 2-Way arming sequence was not successful. Go to step 1 above to repeat the arming sequence.

4. After the system has been successfully Armed, press the F8 "EXIT" key until screen 000000 is displayed.

#### DISARMING 2-WAY

1. Press the F8 "EXIT" key on the IFD until screen number 000000 or 200000 is displayed. The screen number is located in the small box directly above the F8 key.
2. From either screen 000000 or 200000, press the F3 "Operator Functions" key. Screen 300000 will then be displayed.
3. From screen 300000, press the F3 "EOT Setup" key. Screen 330000 will then be displayed.
4. Press the F2 "EOT Setup" key. Screen 332000 will then be displayed.
5. When screen 332000 is first displayed and before any keys are pressed, the F6 key will read "EOT 00000".
6. Press the F6 "EOT 00000" key.
7. The F7 key will then change from "Comm Test" to "Disarm Two Way" and the EOT Status box will display "Disarm Now".
8. Immediately press the F7 "Disarm Two Way" key. Wait until the F7 key changes back to "Comm Test" and observe the EOT Status box.

If the system successfully Disarmed, the EOT Status box will display "Disarmed". The 2-WAY EOT system is now Disarmed.

If the EOT Status box still displays "Armed", the 2-Way disarming sequence was not successful. Press the F8 "EXIT" key one time to go to screen 330000. Go to step 4 above to repeat the disarming sequence.

9. After the system has been successfully Disarmed, press the F8 "EXIT" key until screen 000000 is displayed.



NOTE: After disarming the 2-Way EOT, the EOT Rear Emergency Brake Switch on the engineers console cannot be used to initiate an Emergency brake application from the rear of the train; all other emergency brake valves continue to function. With the 2-Way EOT function disarmed, the end of train unit will continue functioning to transmit end of train information to the locomotive as long as communication is not interrupted.



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